Paving and Municipal Engineering

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MUNICIPAL EQUIPMENT AND ENGINEERING OF PARIS.*

II.

FINANCIAL ADMINISTRATION.

Most travelers and many Parisians regard Paris as synonymous with France. The traveler visits Paris and finds even a few months too short to exhaust its resources. The true Parisian becomes so imbued with the idea of the importance of the French capital that he exaggerates it, and often calls it the capital of the world. At times it has almost amounted to this. But as the Saxon races advance, the Latin races and their allies seem to recede. Paris is no longer the leading city of the world, except in the beauty of its general construction and its vast art treasures and productions. A city attempting to make human existence in every way agreeable, must spend more than many entire nations. Paris does this. It is for the student of sociology to decide whether this object is attained or not. The student of science knows that everything human is but an approximation. I have met, however, several Parisians who regard Paris as little short of Heaven. But I fear even they have at times their doubts. Certainly, in its material equipment, Paris is an example of what can be done when engineers, architects, science and finance combine and honestly administer affairs.

To estimate, collect and disburse, economically, correctly and honestly the enormous sum of 290,117,046 francs ($58,023,409) in one year, means to operate a gigantic and complete financial ma-

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chine, well worthy of our attention. This was the total municipal expenditure of Paris in 1892.

A brief summary of the sources of this revenue, and of the objects for which it is paid out, is all that is possible in the present article. An analysis of the disbursement for the subdivisions of the public work is very interesting, but it is necessary to treat of these topics separately; setting forth, for example, the cost of the streets and the different kinds of pavement and their constant maintenance. Paris paid out in 1892, upon its streets and avenues, 22,890,100 francs ($4,578,020), of which 20,719,700 francs ($4,143,940) was for maintenance and cleaning of street pavements and sidewalks. This represents about what is done every year. The analysis of Paris paving would make an article alone.

The Prefect of the Seine, who is the chief mayor of Paris (the city being divided into twenty arrondissements or divisions with a mayor over each), is chief executive officer. Among other general matters he has charge of the estimates of the funds needed for city expenses. He causes the budget or estimate of the tax levy and income and the appropriations to be drawn up once a year for the following year. It is called "the budget." It contains the details of the expenses of the previous year; the amounts proposed by the prefect. A little later the amounts approved by the municipal council are added and the amounts finally approved by the Minister of the Interior of France. All are arranged in parallel columns. The budget is carefully printed in two documents, one of about 275 pages, twelve inches square, which, while complete enough for usual information, is but an abridgment of a larger publication of more than 3,000 pages, called the *Développements Justificatifs*. This large book of estimates contains the details. It can be had by any student of finance or other person, showing a reason why he can profitably use it, by application to the prefect. The smaller one, ample for practical matters, can be usually had for the asking. A study of these documents is very interesting and instructive.

Statistics, properly tabulated, when carefully and understandingly studied, form a means of information which can be obtained in no other way. They are the means of suppressing evil results and extending good ones.

While our American cities surpass most European cities in many

ways, nevertheless they lack properly analyzed and properly prepared statistics, covering past experience. This fact makes their administration very difficult for our city officials, deprived as they are of this experience of their predecessors. Our short terms of office make tabulated experience all the more necessary, especially in departments of public works. More than enough money is wasted annually in every large American city than is needed to pay for an expert statistician, who would indirectly save thousands of dollars and prevent much inconvenience to which new officials and the public are repeatedly put.

The budget is divided into two parts, called the *service ordinaire* and *service extraordinaire*, *i. e.*, the *usual estimates* which provide for the regular annual and running expenses of the city, and the unusual or *special estimates* which provide for unusual expenses and improvements, not in the nature of renewals. They are applied to additions or extensions of the water-works, main sewers, etc.; in short, what a private corporation would call permanent increase of plant.

Notwithstanding great care on the part of the prefect, the municipal council, the secretary of the treasury and the secretary of the interior, every collection and disbursement is not always provided for in advance. In this case an additional budget is passed. It adjusts a few accounts and provides that certain appropriations can be held over to pay for work of long duration.

To follow the finances to their close we must consult the *comptes generaux* or general account books of the book-keeping division of the financial department. These books are not printed and given to the public. It would be impracticable. But they are open to inspection upon application, as they should be. But the principal items and a tabulated summary is printed in the first column of the budget for the succeeding year, as a basis for estimates.

The following (Table I) is condensed from the budget of 1892. While slightly above the average amounts of the past twelve years, nevertheless the items given are a fair statement of the cost and divisions of the expenses of Paris :

TABLE I.

SUMMARY OF PARIS BUDGET FOR THE YEAR 1892.

Compiled and Translated by J. W. Howard.

[NOTE.—Estimated on a basis of 5 francs, equal to $1. To get exact results, take 96% of amounts given in table, because 5.21 francs equal $1.]

REGULAR RECEIPTS.

SOURCES OF COLLECTIONS.

1.	Octroi, or toll on food and materials	$28,751,871
2.	Direct tax upon property, horses, carriages, dogs, etc	6,415,020
3.	*Receipts from gas companies' taxes, etc.*	3,942,740
4.	Water supplied to private persons and companies	2,614,782
5.	From the state as its share of the cost of Paris police	1,596,513
6.	Public market places and buildings	1,565,528
7.	Fines and permits. Interest on deposits	1,243,000
8.	*Public conveyances, omnibuses, horse-cars, etc*	1,141,240
9.	Receipts and tuitions in certain schools. Legacies	944,964
10.	From the state as its share of maintaining and cleaning streets	680,000
11.	Reimbursement of the city for advances due to private constructions	713,753
12.	Rents and fees from the abattoirs, or slaughter-houses	622,000
13.	*Rents of newspaper and other stands upon streets and parks*	620,040
14.	Public storage and warehouses	618,190
15.	Special charges for cleaning private streets, etc	594,000
16.	*Rent of private telegraph and telephone lines under streets; private sewers*	529,160
17.	Sale, etc., of lots in the cemeteries of the city	467,571
18.	Miscellaneous; sale of official newspaper, use of firemen, etc., at theaters, etc	376,297
19.	Rents from lessees of theaters and property of the city	371,820
20.	Burial permits, undertakers, etc	182,002
21.	Miscellaneous licenses to use the streets	180,000
22.	Sale of old materials from pavements, etc	69,280
23.	Public scales and weighers' fees	59,600
24.	Copies of deeds of sale, and taxes on the same	49,600
25.	Private donations of income from endowments for charity	6,038
	Total of regular receipts	$54,354,009

SPECIAL RECEIPTS.

1.	Contributions of the state, etc., to restore deeds destroyed in 1871	9,400
2.	Interest upon deposits of special funds	100,000
3.	Sale of city real estate	40,000
4.	Sale of city real estate and extra materials	60,000
5.	Miscellaneous receipts	18,000
6.	Product of special loan authorized in 1886	3,400,000
7.	Sale of real estate and building materials from 1886	20,000
8.	Special appropriation of 1891, held over	22,000
	Total of special receipts	$3,669,400
	GRAND TOTAL OF COLLECTIONS, OR RECEIPTS	$58,023,409

REGULAR EXPENSES.

OBJECTS OF DISBURSEMENTS.

1.	**Payments of interest and part of principal of city debt**	$21,550,095
2.	*Regular public schools of all grades*	4,940,678
3.	**Police department and courts**	4,840,322
4.	**Public hospitals. Help for the poor. General charities**	4,794,111
5.	*Maintenance pavements, $2,298,460. Sidewalks, 469,300. St. cleaning, 1,314,400. Gen'l, 61,780*	4,143,940
6.	*Public parks. Public lighting. Inspection of public conveyances*	2,376,875
7.	**Administration of octroi or toll on food and materials**	1,708,726
8.	*Maintenance and cleaning of sewers*	1,704,540
9.	**Administration of the prefects and offices, finance department, etc**	1,492,265
10.	**Shares of state tax, collection of taxes, etc**	1,214,460
11.	*Administration of the public works and supplies of Paris*	964,428
12.	*Maintenance and construction of city buildings, architecture and art*	889,402
13.	**Reserve funds, emergency expenses**	719,798
14.	**The Republican Guard, a special local force**	535,540
15.	**Fire department**	534,928
16.	**Surveys of streets, etc. Plans of city, control of building lots, etc**	434,080
17.	*Subsidies and other aid to higher institutions of learning*	306,652
18.	**Administration of market places and buildings, etc., of the city**	259,390
19.	**Administration of the cemeteries**	250,136
20.	*Pensions to old employes of the city, all classes, or their widows, etc*	238,135
21.	**Military expenses, etc**	195,630
22.	**Administration, etc., of the 20 offices of the sub-mayors**	176,390
23.	*Municipal chemical laboratory*	56,650
24.	**Miscellaneous, astronomical, meteorological and scientific, etc**	21,538
25.	**Commission to examine, etc., drivers of public conveyances**	5,500
	Total of regular expenses	$54,354,009

SPECIAL EXPENSES.

1.	**Restoring records and deeds destroyed by the commune in 1871**	17,200
2.	**Purchase of real estate**	111,000
3.	**Extensions of main sewers**	60,000
4.	**Reserve for emergency expenses**	39,200
5.	**Laying out new sections of city, increase of water-works, etc**	3,400,000
6.	**Miscellaneous public permanent improvements**	20,000
7.	**Special bills held over from 1891**	20,000
8.	**Special bills held over from 1891**	2,000
	Total special expenses	$3,669,400
	GRAND TOTAL OF DISBURSEMENTS OR EXPENSES	$58,023,409

To better grasp the financial investments and standing of Paris, I have drawn up Table II, which gives the condition of the debt of Paris in 1892:

TABLE II.

DEBT OF PARIS.

(NOTE: For exact value of money in 1892, deduct 4 per cent. from items given.)

Divisions of Debt.	Original Debt.	Repaid Previous to 1892.	Paid During 1892.	Due After 1892.	Interest, etc., 1892.
Bonds or loans, general	$451,359,290	$82,065,438	$5,180,499	$364,113,353	$19,019,589
Bridges, canals, water-works, etc	29,757,218	11,657,829	530,006	17,569,384	1,078,280
School buildings, etc	906,810	108,708	26,236	771,866	27,129
Totals	$582,023,318	$93,831,975	$5,736,741	$382,454,603	$20,124,998

When we remember that labor is cheaper in Paris than in America and that the city officials are paid about one-half what we must pay them here, we understand at once the greater purchasing power of money in Paris. In order to compare Paris with what a city similarly equipped and as well administered would cost if in the United States, we must add from twenty per cent. to twenty-five per cent. to the items given for Paris; or *vice versa*, by deducting about these per cents. from the expenditures of the American cities, we bring them to the French basis of cost. But the fact remains that rapid growth and other causes have prevented most American cities from enjoying such efficient and permanent improvements as Paris enjoys. There are a few prominent exceptions which show what our cities can do when trained and honest men are put in control; men willing to investigate and profit by the experience of other cities; men above any temporary or passing influence and who regard a city as an organism the future health and prosperity of which is to be respected as well as the present needs.

Paris, indeed, spends a vast fortune annually, but as a rule, wisely; producing experience and results freely open to all to profit by and to enjoy.

It will be noticed that real and personal estate are not the basis of the income of the Parisian treasury. It is evident from an examination of Table I that the direct tax on real and personal estate constitutes only about 11 per cent. of the income of the city. According to the law of France, revised April 5, 1886, the *population* of Paris is the basis of taxation. This means that a method exists of taxing the 2,344,550 inhabitants of 1892 according to what they possess

and consume. This is done effectively by the celebrated *octroi* or toll levy upon all supplies of food and raw materials crossing the city limits into Paris. This is an indirect tax. While amounting to fifty per cent. of the income of the city each year, it is the least felt by the individual citizen.

The following (Table III) shows the amounts collected at the many points of entrance into Paris by the employees of the octroi or toll department:

TABLE III.

PARIS TAX ON FOOD AND RAW MATERIALS.

(*An Average Year.*)

Classes of substances taxed.	*Collected in 1888.*
Beverages of all kinds	$11,766,643
Alcoholic medicines	57,014
Liquids other than beverages	3,245,905
Provisions or food of all kinds	6,382,223
Toll on live cattle passing through on foot	397
Fuel of all kinds	2,749,727
Building materials	1,472,727
Lumber, boats, etc	909,042
Fodder	991,879
Miscellaneous articles	477,402
Small collections	2,512
Fees at the warehouses	64,620
Certificates to take out and return material, etc	13,165
Fuel used at factories	98,349
Total	$28,231,805

In these days of discussion of city franchises, it is very interesting to glance at what Paris has done in the matter of granting franchises to the gas, electric light and street car corporations. It is instructive to learn what Paris makes these companies pay for the use of the public property of the city; that is to say, for the use of the streets. The city authorities, with wise foresight, arranged that while these companies can earn reasonable profits they must pay handsomely for the use of the city streets. These streets have cost enormous amounts to establish, grade, pave and otherwise equip and beautify, both above and below ground; and they must not be given away, in part even, for nothing.

The gas companies pay an annual royalty of 14,000,000 francs ($2,800,000); also 2 centimes per cubic meter (11 cents per 1,000 cubic feet) of gas sold; also a rental of 200,000 francs ($40,000) per year for the use of certain portions of the underground passages

and sewers. The city received in 1892 from the gas companies a total of 19,713,700 francs ($3,942,740), or 6 per cent. of the municipal income.

The horse car and omnibus companies paid a tax of 2,000 francs ($400) per car or vehicle per year, making a total for these companies from this and other charges of 2,146,200 francs ($429,240). Other public conveyances and carriages paid in 1892 3,560,000 francs ($712,000). The total income of Paris from horse cars, omnibuses and public vehicles was 5,706,200 francs ($1,141,240), or 2 per cent. of the city expenses.

The extension of the city means additional streets, sewers, pavements, etc. These call for increased expenses. This annual increase is in proportion to the growth of the population. The taxes per individual, however, are decreasing.

The success attained can be judged from the fact that the Parisian does not complain but constantly praises his beautiful, smooth, clean streets, handsome parks, beautiful public buildings, etc. He knows, too, that these things, while pleasing himself, also attract thousands of people from the entire world. These people visit Paris to enjoy its resources and beauty, at the same time spending in the city more money, perhaps, than the vast improvements have cost.

It is well for each city to remember that attractive streets, parks, etc., not only persuade its inhabitants to remain citizens of the place when they become richer and older, but also induce many new people to select such a city for their abode. Above all, it makes life more agreeable for the masses who must live in the place, and acts as a great educator of the children who are to succeed us.

Paris has a simple and safe system of receiving and disbursing its vast income.

Its financial methods, while equaled by the handsome, clean, well-paved modern Berlin, are by no means equaled by London, Vienna, or other large city of the world.

The city treasurer is called the *receveur municipal*. He receives and deposits all money due the city and pays it out upon written orders called mandats, signed by the prefect. The receveur is appointed by the concurrence of the prefect, the secretaries of the interior and treasury of France, and the city council. He is paid one of the highest salaries in Paris, $8,000 a year. He is under

$80,000 bonds. His responsibility is great. He must possess excellent executive ability.

There are three chief inspectors of accounts who, with their assistants, constantly scrutinize all accounts, receipts, etc., of the finance department. We would call them comptrollers. They also watch the book-keeping and every operation of the collection as well as the disbursement of public money. All records are thus assured of being kept in a proper, uniform and permanent manner. They are finally put away in secure vaults for future reference.

MAJOR J. W. HOWARD, B. L., C. E.

See biographical sketch in January number, 1893, page 6.

These inspectors also verify the truthfulness of the statements of the gas, omnibus, horse-car and other companies which pay portions of their profits to the city.

The employes of Paris may have faults, but neglect of duty is not one of their weaknesses. They are noted for honesty and precision, as well as for the courtesy they extend to any one having dealings with them, be he Frenchman or foreigner.

J. W. Howard.

BRICK STREET PAVEMENTS, FROM START TO FINISH.

THERE is perhaps no paving material in existence to-day which gives more general satisfaction for a moderately heavy traffic than a good quality of paving brick. This statement is borne out by the fact that a large number of the smaller cities and towns in various parts of this country have, within the past few years, adopted brick as the standard material for street pavements.

Numerous and extensive plants for the exclusive manufacture of paving brick have been erected at different places, where suitable clay deposits exist, and while the big majority of these plants turn out a serviceable article, it must be admitted that a very inferior quality has been furnished by not a few, owing partly to the inexperience of the manufacturers in this new industry, but mostly to the unsuitable quality of the clay used by them for this purpose, and as the demand for paving brick has so far exceeded the supply, they have been able to find a ready market for their ware,

with the result of bringing brick pavements into disrepute wherever the supply has come from these sources.

The writer has in his possession samples of paving brick from a large number of plants, some of which are as hard and tough as the best quality of granite, and which would prove fully as durable, under extremely heavy traffic, while others are not much better than a poor quality of limestone, which goes to show that there is a vast difference in the quality of paving brick. This is not alone, however, the case between the product of different plants, but between bricks burned in the same kiln, owing, in the latter instance, mostly to the unequal distribution of the necessary heat to fuse or vitrify the bricks uniformly.

Will not attempt to discuss the manufacture of paving brick, as that has been and is being done by others, who are experts in this branch of the business, but merely point out the fact, that in order to obtain a first-class pavement, the material must be carefully inspected, to do which, one must know the essential qualities required in a good paving brick, which may be summed up as follows:

Resistance to Abrasion.
Percussion.
Crushing.
Absorption.

To ascertain the resistance to abrasion, some engineers recommend placing samples, together with a lot of irregular pieces of cast-iron, in a foundry rattler, making from 40 to 60 revolutions per minute, and noting the loss in weight, by weighing the samples before and after the operation. This test, while determining to some extent, the toughness of a brick, is not applicable here, since the brick in the rattler is exposed to wear on all sides, while in the pavement only on one; hence the result of this test is not the same as that of actual wear.

A more satisfactory test can be made by taking a brick and a piece of granite, of which latter the resistance to abrasion is known, and after weighing each sample accurately, rub them together the same as a marble-cutter in polishing granite or marble, weighing them again after the operation and noting the percentage

of loss in each sample, when their relative resistance to abrasion can be readily deduced.

Tests for resistance to percussion are best made with a light steel hammer (such as is used by pavers for clipping brick), by striking the brick moderately sharp and repeated blows, producing as near as possible the same effect as the sharp, steel-pointed shoes of a trotting horse, which latter will injure a weak brick quicker than a heavy load drawn over it at a moderate gait, since owing to the smooth and even surface of brick pavements, there is no impact or pounding process of the passing wheels, as is the case with granite or other stone block pavements.

Tests for resistance to crushing are usually made with machines designed for the purpose of testing samples of various materials to destruction, noting the weight in pounds, when cracking or spawling begins, and at final crushing, by which means the crushing strength per square inch of surface is ascertained. This test has no further value than to merely establish the relative crushing strength of brick as compared with other materials, since a comparatively soft brick will sustain considerable of a dead load, when placed in the walls of a building, but will crumble and go to pieces, when subjected to the traffic of a street pavement, under a much lighter, but live, or moving load.

The test for resistance to absorption is one of the most important, as no brick will withstand the action of frost successfully (no matter how hard and tough it may be otherwise), which will absorb more than five per cent. of its own weight of water after being immersed from five to fifteen days.

In testing brick for this purpose, the samples should be thoroughly tried, then carefully weighed and immersed in clean water, then taken out and weighed at intervals of from two to five days until no more absorption is noticed.

In addition to the foregoing tests, some engineers advocate tests for tensile strength, resistance to the action of acid, etc., but the writer considers them superfluous, since the position of a brick in a street pavement is entirely different from that of a beam in a structure, and as to the action of acid, it must be a very poor brick that will not bear this test after having passed through the process of burning, unless charged with a large percentage of lime, in which

case the absorption test will seal its fate by slacking the lime and causing disintegration.

As previously stated in this article the quality of paving bricks from one and the same plant even, is not sufficiently uniform to depend entirely on tests of samples, especially when it must be conceded that samples are selected with greater care by the manufacturer when sending them to the person who proposes to make the test (unless that person goes to the plant and selects them himself, which, however, is not often the case), than when shipping for actual use. Besides, the facilities for making some of the tests, notably for crushing and tensile strength, are wanting in a large number of the smaller places, and being out of the question of subjecting all or even a small number of the bricks to the various tests, it will be seen that it must depend very materially on the honesty and good judgment of the inspector whether the material employed will prove serviceable or not.

After the average quality of the output of a plant has been sufficiently established by either actual wear in a street pavement, for a number of years, or by thorough and repeated tests of the medium as well as the best specimens, a man of good common sense and sound judgment will have no difficulty in assorting and inspecting paving brick from such a plant in a satisfactory manner, which may be accomplished by adopting the following method:

Have the bricks dumped or thrown from the wagon, when delivered at the line of work. Throw out all such that will not stand this handling successfully. Then after a portion of the pavement has been laid, but before the surface has been sanded, or grouted as the case may be, go over the same carefully and remove all defective bricks, take up and apply the hammer test, as noted heretofore, on such specimens as may appear somewhat soft, by reason of their pale color, which is the case when not sufficiently burned, or those which are very dark, but likely to be porous on account of being overburned, and if they stand this test immerse them in water and observe if small air bubbles appear on the surface in quick succession, or a material change of color takes place, by reason of the large percentage of water absorbed, in which case throw them out, as they will not resist the action of frost successfully.

In addition to a thorough and close inspection it will be good

policy to exact a sufficient guaranty from the contractor, for a period of not less than one year from date of completion of his contract, to replace, at his expense, any defective material which may have escaped detection before, and in this way secure a satisfactory job at the original contract price.

After having secured a good quality of paving brick the next question to be considered is how to construct a suitable foundation, as no pavement, no matter how excellent the material of its wearing surface may be, will prove serviceable or satisfactory unless supported by a solid, unyielding foundation.

The first step to be taken in this direction is to ascertain the condition and nature of the subsoil. Should it be spongy or liable to become saturated with and retain more or less ground water, underdrainage must be resorted to, which may be accomplished in the following manner: Lay ordinary drain tile of sufficient capacity, in no case less than three inches internal diameter, about one foot below the base line of the foundation and from six to nine inches back of the curb, towards the property line; fill over the tiling to a depth of about nine inches, with screened gravel or clean cinders, to prevent filling and stopping up the joints and eventually the drain with fine sand or other small particles, and provide a suitable outlet by connecting with a catch-basin at a convenient street corner, or, if this can not be done, by constructing a receptacle which should be bailed or pumped out when occasion requires, or if the topography of the ground permits, by discharging into the open air, in which case a suitable screen should protect the outlet, to prevent rats or other vermin from entering it and destroying its usefulness.

When one side of a street is lower than the other, and the ground adjoining the lower side continues to descend rapidly, no underdrainage will be necessary on that side, as a well-constructed brick pavement will let no appreciable amount of moisture through to the subsoil, after the joints are once thoroughly filled with fine sand, while the drain on the upper side will prevent any water from entering below the pavement there. For this reason, also, it is preferable to lay the drain back instead of in front of the curb and under the gutter, as is done in most cases with macadam, telford or stone block pavements, which, by reason of their porosity, let a large amount of surface water through; besides, the gravel or cin-

der filling over the tiling, which is to act as a filter, would have to be rammed solid (and thereby decrease its efficiency) when placed under the pavement, while if placed back of the curb it can be left more porous, and consequently will serve its purpose better. Should the subsoil be porous, or cellar excavation exist on each side of the street, which is mostly the case in the business portion of a city, no subsoil drainage will be necessary, as no material amount of moisture can accumulate under the pavement, and therefore the provision for such drainage would prove a useless expense.

Having decided the question of under-drainage, the next thing to be considered is the preparation of the road-bed, on which the foundation is to rest. The subsoil should be excavated to a depth of not less than one foot below the top level of the finished pavement (unless said subsoil should consist of sand, gravel or rock, in which case a depth of from seven to eight inches would be sufficient), and then thoroughly and repeatedly rolled (with a roller weighing not less than one ton per lineal foot of face of roller). All depressions which may then appear should be filled with sand, gravel, cinders or macadam, and the rolling continued until every portion of the road-bed becomes uniformly compact and firm, with its contour corresponding precisely to that of the finished pavement.

Following the preparation of the road-bed comes the construction of the foundation, which should be solid and unyielding, for reasons stated heretofore; and to secure these conditions, various methods and different materials are employed, of which I will cite the following, and endeavor to point out their merits and defects:

Concrete Foundation.—This foundation usually consists of a layer of concrete about six inches thick (the composition of which and the method of preparing it I will not here discuss, as this has been done in a number of published works, and no doubt every one connected with the engineering profession is sufficiently informed on this subject), and when properly constructed has no superior, as regards sustaining heavy loads; but the frequent tearing up of streets, caused by making repairs of, and connections with, the various underground systems, such as sewers, gas, water and steam-heating mains, in all seasons of the year, when it is often next to impossible to replace it to its former conditions (were the average plumbers' forces willed to do so, which they usually are not), and

thereby greatly destroying its efficiency. Besides, the danger of leaks in water, steam, and especially in gas mains, remaining undetected until a weak spot in some foundation wall tells the tale, but does not locate the leak, when it may become necessary to sink a number of test pits before the right spot is reached.

These objections apply with equal force to such pavements as asphalt and all others in which the joints are filled with various ingredients for the purpose of making them impervious. The only way of overcoming this serious obstacle is by placing the various underground systems in conduits of such dimensions as will admit of being entered through man-holes by workmen to make any necessary repairs without tearing up the pavement.

From the foregoing it will be seen that so long as these conditions are not the exception, but the rule, in nearly every American city, it may not prove the wisest policy to adopt that which, besides being the most expensive is really good and unobjectionable only under certain conditions, when something else less costly will answer the purpose fairly well, under all conditions.

Broken Stone and Sand Foundation.—On the road-bed (prepared as described heretofore), a layer of broken stone whose longest diameter shall not exceed two and one-half inches shall be spread over the entire surface to an even depth of about four inches and all voids filled with sand, then thoroughly rolled, until uniformly compact and solid, after which another layer of the same material and depth shall be placed on the first and rolled as before, making the combined depth of the two layers seven inches after the rolling is completed.

Broken Stone and Sand, Gravel, Furnace Slack or Cinder Foundation, with one layer of brick laid flat and lengthwise with the street.—This foundation is constructed in a similar manner as the preceding one with this difference that the material constituting the bottom layer, be it stone or sand, gravel, furnace slack or cinders, shall be spread in an even layer to insure a depth of four inches after being thoroughly rolled, then a layer of sand one inch in depth is spread over it and scraped with templets (which are hollowed out on the under edge to correspond precisely with the contour of the finished pavement), upon which a course of brick is laid flat and lengthwise with the street, care being taken to break joints the

same as when laid in a wall and laid as true to a line as practicable. The surface being then thoroughly rolled with a hand roller weighing about five hundred pounds per lineal foot of face of roller; or, if no roller is available, it may be rammed with a rammer weighing from seventy-five to ninety pounds, brought in contact with an eight-inch plank two inches thick, which should be placed lengthwise or parallel with the rows of bricks and the blows repeated until the rammer rebounds, all broken bricks to be removed and replaced by whole ones pressed securely into place.

The bricks used in this layer do not require to be of as good a quality as those composing the top layer or wearing surface, not being subjected to chipping or wearing but merely to compression, and this in such a modified form, by reason of the layers of sand above and below them, so that a comparatively weak brick will sustain an extremely heavy load without being injured; therefore a brick having an ultimate crushing strength of only three thousand pounds per square inch will prove efficient, and a foundation constructed in the manner and of the material here indicated will give entire satisfaction, as has been practically demonstrated by a large number of cities and towns.

Ordinarily, it is assumed that a foundation of this kind is more expensive than one of broken stone and sand alone, which is true only when the latter material can be procured at home at a nominal cost, and the bricks have to be brought from a distance where the charges for transportation add materially to the cost; but the conditions are entirely different when this order of things is reversed, especially when it is considered that in the first place this class of bricks are generally sold at a reduced cost, and in the second place the manufacturer would have to charge more for the better quality if unable to dispose of the inferior, in order to secure a fair return from his capital invested. Besides, this layer of bricks will insure a more uniform bearing surface than the other unless the same is constructed with the greatest care and under the most rigid inspection.

On the whole, however, it is of little consequence how or of what material street foundations are constructed so long as satisfac-

tory results are obtained, at the least original cost as well as the easiest and cheapest subsequent repairs, and for this reason the material found nearest home should have the preference, if found suitable for this purpose.

Having considered and discussed the various questions relating to the construction of a serviceable street foundation, we will now turn our attention to the finishing of the pavement, which may be done in the following manner :

On the foundation thus prepared spread an even layer of clean sand of uniform quality one inch in depth, raked or scraped with a templet of the required form, as stated heretofore. Upon this layer of sand place the top course of brick edgewise and at right angles with the street, break joints and lay true to the line, the same as specified heretofore for the lower layer. At street intersections place them at an angle of about forty-five degrees with the street in such a manner that the wheels of a passing vehicle will strike them at an angle and thereby distribute the load more uniformly over several bricks instead of throwing it on to one, which would be the case if bricks were laid parallel to the line of travel, causing unequal wear and formation of ruts. After having the bricks in position for a block or a portion of a block, should it be rather long, make a careful inspection, as described heretofore, then roll or ram the surface thoroughly, as the case may be, until every brick is securely settled into place, and after removing such bricks as may have been broken by this operation and replacing them with whole ones, spread a thin layer of fine sand over the entire surface and broom carefully in the joints, which operation is to be repeated several times (if the sand should not be perfectly dry) before the joints are completely filled, after which the street can be thrown open to the traffic.

In some localities the top course of bricks has been, and is perhaps, still laid herring-bone fashion, which, while having no particular advantage (as regards wearing qualities) over a pavement like the one just described, will require better skill and consume more time in its construction, adding to the cost without increasing its efficiency correspondingly. *William Steyh.*

WILLIAM STEYH was born September 17, 1845, in Kesselbach, Province Oberhessen, Hessen Darmstadt, Germany. He attended the public schools from 1851 to 1859, graduating therefrom at the age of fourteen and, finding employment shortly after with a surveyor, assisted in land surveying and highway construction for the following six years, pursuing studies in geometry, trigonometry, etc., during the winter months, aided by a kind tutor, who for a small consideration employed his spare time instructing young men eager to acquire a professional education, but whose parents did not possess the necessary means to send them to college. From 1865 to 1866 Mr. Steyh assisted in railroad surveys, which work was suspended indefinitely on the declaration of war between Prussia and Austria, and as the prospects for employment in the various branches of surveying and engineering continued rather gloomy, even after peace had been restored, he concluded to bid farewell to the fatherland and go to the land of the free. After landing in New York, in June, 1867, and paying a visit to relatives in Wheeling, West Virginia, he continued the westward journey as far as Burlington, Iowa, where, in the spring of 1868 he found employment on the Burlington & Missouri River railroad in the western part of Iowa and the eastern part of Nebraska. He remained in the employ of this company till the early part of 1870, resigning the position of assistant division engineer on construction to engage in mercantile business at Burlington, Iowa. After a year and a half he returned to engineering, taking charge of the construction of a small water-works plant at the Iowa Hospital for the Insane, at Mt. Pleasant, Iowa, including the laying out of a portion of the grounds belonging to this institution, which work was completed in the latter part of 1872. From 1873 to 1878 he surveyed and had charge of the construction of four street railway lines and engaged in a general practice of surveying and engineering at Burlington, Iowa. From 1878 to 1882 he followed railroad engineering in the employ of the Chicago, Burlington & Quincy, the Burlington & Missouri River, and the Burlington & Western railroad, respectively. From 1882 to 1892, with the exception of 1884, he has been city engineer of Burlington, Iowa.

INSTRUCTIONS TO SEWER INSPECTORS.

MR. ARTHUR LAGRON, C. E., sends to PAVING AND MUNICIPAL ENGINEERING, the following copy of instructions to sewer inspectors prepared by him :

Grade.—Grade of an even number of feet above the bottom of the sewer will be given to the contractor or his foreman by the city engineer, or his assistant on a stake driven on one side of the ditch, far enough to prevent all possibility of being disturbed, then another stake will be driven on the other side of the ditch and a straight board nailed across, said board to be leveled with a hand level and the center line of the sewer will be marked on it.

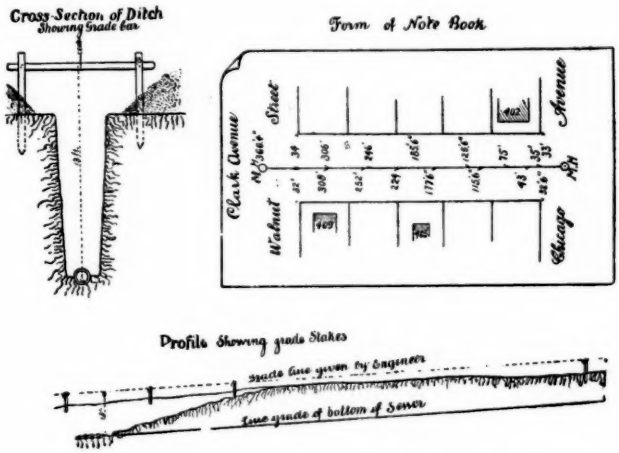
Such grade stakes may be established every fifty feet, but in all

cases there shall be one established ahead at the next manhole or lamphole, and all intermediate cross bars shall line to it.

A grade line may be stretched from cross bar to cross bar and supported in the center if the distance be too great to stretch it perfectly straight.

All vertical measurements must be made with a stiff rod, and in no case with a tape.

Although the contractor is by the specifications made responsible for the carrying out of the grade you are to keep a strict and constant watch that it is done accurately and that no changes or alterations are made.



Filling.—Permit only fine dry material to be used for back filling next to the joints, and see that it is put in place in a manner that will not disturb the cement. The filling must be well tamped on both sides of the pipe. Do not allow workman to step on the pipes until tamped and filling is sufficient to protect them from being disturbed.

Laying.—See that when practicable, the bottom of the trench is as near as possible made to fit the lower half of the tile, that the body of the tile rests on the solid ground in preference to the socket which should have an excavation specially dug for it. See that the line is kept straight, which can always be ascertained by plumbing from the grade line above.

Joints.—See that each joint is wiped clean of cement before an-

other pipe is laid. See that the socket of the pipe last laid is clean of dirt and gravel, etc., before the bottom is cemented and the spigot inserted, and then see that the pipe is sent well home. Be sure that the cement put on the top reaches far enough on both sides to join with the cement put on the inside and make the joint actually water tight.

Cement.—Cement should in no case be mixed with more than twice its bulk of sand, that is to say one part of cement for two parts of sand. When the bottom of the trench is wet more cement is needed.

Pipes.—All pipes not a true circle must be rejected. Cracks, large blisters, scaling off of the vitrification disqualify pipes. When more than one-fourth of the socket is broken off the pipe must be rejected, and where any part of the socket is broken off, the break must be placed uppermost, and the break made good with brick carefully laid in cement.

Y Branches.—Ascertain from property holders, when possible, where they desire their junction located. Where this can be done, locate them in reference to lot lines where they are most likely to be needed.

Mark each Y with a strip of 1x2 inch plank set in the trench extending from the bottom to the surface, and in filling, see that these strips are cut off (not broken off), flush with the surface.

Carefully measure the distance of each Y from the center of the last manhole, record the distance and the direction in which the Y points, and house number opposite, when any. Also measure the distance from the last Y to the next manhole, so that the Y's may be located by measuring either way from the manholes. Measurements must be from manholes, in no case from Y to Y.

Miscellaneous.—If any extra work is required from the contractor, keep an accurate account of it, or if any timber is ordered to be left in the trench, keep strict detailed measurement of it.

When in doubt, never assume that you know, but refer to the city engineer.

When the work is done, turn your note book over to the city engineer's office.

ELECTRIC LIGHTING AT TOPEKA, KANSAS.*

THERE are few wants more necessary in a well regulated community than light. After securing a generous supply of pure fresh air, good wholesome water, clean streets and surroundings well drained, we need light by night as well as by day. During the last few years many of our smaller cities, seeing the improvement made in larger places, have secured electric light plants. Some, from a spirit of rivalry, have gone into these enterprises blindly, without counting the cost or carefully considering the questions involved. The strong convincing argument in favor of the arc lamps is the great concentration of light in one lamp. But the light received is as the square of the distance lighted, a fact that is often overlooked.

There are many inquiries constantly being made as to the cost and operation of an established plant. One of the first asked is, does the city own its plant? a question in municipal economy which should receive more attention. That a city should be free to supply its own needs and that of its citizens at cost, without the presence of middlemen to overcharge or discriminate, would seem self-evident.

The next important question is the cost. In reply to such questions, the author has prepared a tabulated statement, taken from the reports of the superintendents which covers the operation of the plant for the last twenty-six months, giving the number of nights and hours run each month and the principal elements of cost, together with the cost of fuel for each horse power for one night and hour.

The plant belongs to the city of Topeka; it was contracted for in February, 1888, and furnished by the Jenney Electric Company, of Indianapolis. There are 184 double carbon arc lamps, 3 boilers 16 feet long, 54 inches in diameter, with 45 flues 4 inches in diameter; 3 Ball engines of 75 horse power with 80 pounds of steam pressure, intended to run 250 revolutions a minute, 6 dynamos of 30 arc lamp power, connected with 6 circuits which together have 24.72 miles of line and 33.5 miles of wire; the line is suspended upon 30-foot cedar poles, and the lamps are suspended at the center of the

* Read to the American Society of Civil Engineers.

street intersections between two 40-foot poles. Soon after starting it was found necessary to use more than 80 pounds of steam pressure, and in doing this the capacity of the boilers was found inadequate, except with the best bituminous lump coal. From the tests and experience of a superintendent who was in charge of the plant about one year, it was found that the three engines had to work up to 235 horse power to keep the lamps burning steadily. The exact actual horse power record has not been kept during all this time.

The accompanying table shows some irregularities. Owing to lack of boiler capacity the plant has to be shut down two nights each month to clean them. This is usually done on moonlight nights, but sometimes it is cloudy and the moon obscured, much to the annoyance of the people. In October, 1891, the plant was shut down for fifteen days to reset the boilers.

The monthly statement of the cost of coal is for coal received and paid for during the month; this comes by the carload, which is ordered as needed, and very little is kept in stock at any time. Owing to the lack of capacity of the boilers, the poor and cheaper coal, such as is used by other electrical plants in the city, can not be burned.

An expert tested some of the lamps without the knowledge of the superintendent and operators, and found as an average of seventeen lamps in different parts of the city a pressure of 23.15 volts, a current of 19.0 amperes, and an electromotive force of 439.85 watts. The manufacturers of electrical plants using arc lamps have fixed an arbitrary standard of their own for candle power. Six of the largest companies allow from 432 to 480 watts for a 2,000 candle lamp; the average of these is 450 watts to the lamp or 4.44 candles to the watt. The author has endeavored to find some reason for these assumptions, but knows of none except that they overrate their lamps for what they can gain by imposing upon their customers. The best authority that he can find on the subject is Gordon Wigan, A. M., whose work was printed in 1884 by Casel & Co., New York, and who makes one watt equivalent to 1.63 candles and cites a test of candle power at the Paris Electrical Exposition of 1881, when the Brush lamp was tested and shown to be 741 candle power. By the American manufacturer's average arbitrary stand-

ard the 17 lamps tested averaged 1,953 candle power, allowing 4.44 candles to the watt; but taking Wigan's and the European practice our lamps are only 717 candle power, allowing 1.63 candles to the watt.

This is a great difference, when it is considered that we use the same English standard candles as are used in Europe and elsewhere, for our standard in this country.

COST FROM NOVEMBER, 1889, TO DECEMBER, 1891.

Nights run	672.00
Hours run	5,430.17
Average number of hours run	8.08
Coal consumed, tons	3,587.03
Cost of coal	$9,646.16
Cost of coal per horse power per night	6.11
Cost of coal per horse power per hour	.76
Cost of carbons	2,146.11
Cost of globes	159.05
Cost of oil and waste	504.35
Cost of repairs	3,045.78
Insurance and telephone	905.84
Pay roll, superintendent and labor	13,420.99
Interest on cost of plant, 6 per cent.	7,208.24
Total cost	37,036.52
Average cost per lamp per month	7.74
Average cost per lamp per 100 hours	3.71

PER CENT. OF TOTAL EXPENSE.

Coal	26.04
Carbons	5.79
Globes	0.43
Oil and waste	1.36
Repairs	8.23
Insurance and telephone	2.45
Pay roll	36.24
Interest	19.46
Total	100.00
Cost of lots and buildings	$8,559.33
Cost of plant, poles and wires	46,888.65
Total	$55,447.98

The location of the electric lamps in our city has been a subject of much criticism, with one lamp at every other street intersection; the lamps are about 1,100 feet apart one way and 800 feet the

other; the intervening intersections are not well lighted, which is hardly fair to the people living there. With one lamp at every intersection the light would be of much more value, even though the intensity was only one-half of the light of the present lamps.

We have in addition to our electric lamps 222 vapor lamps furnished and lighted by contract at $1.75 per month. These are located in the outlying districts. People complain because they are so insignificant as compared with the arc lamps, and when one compares a vapor lamp of 10 candle power with a 700 candle power lamp, it is not much to be wondered at that some of these districts should complain through their representatives.

The city of Topeka is spending $21,260 a year for lighting its streets, and yet people are not satisfied. About one-half of those inside of the electric light district feel that an injustice has been done them, and all the people outside of this district seem to think they ought to have as good light as the electric lamps furnish, as they are assessed in the same proportion as those who have them.

What we need is a system of lamps at every street intersection, with one circuit covering the business portion of the city on which the lamps shall have an intensity of 1,000 actual candle power.

Then with circuits covering the residence and outlying districts on which the lamps shall have an intensity of 200 candle power. One objection, perhaps, to this would be the large additional number of lamps to clean, adjust and take care of; another would be the long distance for the transmission of the electric current and consequent loss or leakage.

The present arc lamps are good, perhaps perfect in themselves, yet the cost is so great that a city occupying a large territory can not expect to light all and do equal justice to its citizens.

The Edison lamps have not the candle power suitable for street lighting, but it would seem to the author that a system between the two would be more suitable for many of the growing cities in our country.

The cleaning of the arc lamps and globes is a large item of expense and is seldom done perfectly. Fifteen per cent. of light is absorbed by a good clean globe, 70 per cent. by an opal globe, and about the same amount by a dirty globe. The rods of an arc lamp must be kept clean or it will fail to burn, and the cleaner is at once

reminded of his duty; but he can allow the globes to become obscured so that from 50 to 70 per cent. of the light is absorbed without any serious complaints from an average citizen. Municipal engineers are largely interested in the question of light. We should try and secure its proper diffusion, that equal justice may be done to all. An engineer should first know what his city needs, and then be able to advise, and prevent a fluent agent of a strong illuminating company from selling an extravagant plant, poorly adapted to the wants of the people. *Louis Kingman.*

MAINTENANCE OF ROADS IN FRANCE.

II.

THE use of material for repair is a necessary operation that can not be dispensed with, yet it does not require a continual attention like the sweeping. In fact, if the road is kept clean, the road-bed wears out uniformly (or very nearly so), and it does not matter much if, for a certain length of time, instead of twelve inches thick it gets to be only ten or eight. The public does not see it; therefore the engineer or the "cantonnier" can choose his time to spread his new stones.

The best time is when the weather is wet, because when it is dry and the road is hard, the new material does not incorporate with it. The stones keep rolling about and get crushed to powder, without any benefit to the road and to the great annoyance of the travelers, while when the weather is damp, with some proper care, it assimilates and gets thoroughly united with the old road-bed without getting scattered about, and is of very little hindrance to the travel, so when frequent rains have softened the road-bed and that frost is not anticipated, then it is the proper time to spread new material on the road.

The principle that must govern the "cantonnier" in performing that work that naturally tends to make the road "pull harder," is to avoid creating any motive that would invite the wagons to follow one direction rather than another, and that is easy where a road has been kept clean. One does not see those long holes or depressions

either on the center or on the sides that seem to necessitate extensive refillings; instead, light depressions are seen from one to two inches deep. Those are the places to fill, and as their depth, say two inches in the center, decreases gradualy to nothing on the edges, it is necessary that the "cantonnier" should pick the perimeter in order to give the new filling a solid bearing. Then he carefully spreads his stones on that hole, thus circumscribed, the biggest stone in the center and the smallest toward the edges. Those patches should not be more than from six to ten feet in length and from three to six in width. The same operation is to be repeated for all the little depressions, yet if they were too close together it would hinder the travel to a too great extent. It would then be preferable to fill only the deepest first, and when these would have become solid go over again and fill those that would have been left at first.

When a certain length of road, say 200 feet, has thus been repaired, it would be a grave error to believe that it is finished, and it is an error too often made. On the contrary, the cantonnier must bear in mind that it is the place that requires the closest attention, because those stones are often and continually displaced by the horses' feet, or by the wheels, and unnecessarily crushed, or kept rolling for an indefinite length of time, so he must, every now and then, go over with a rake and replace them.

Also in spite of all his skill in placing his new filling so as to break the wagons from their tendency to follow the same path they sometimes show a preference for one side rather than the other, then he has to do some new filling, or tear up some one already made, until he compels them to go equally all over the road.

ARTHUR LAGRON, C. E.

See biographical sketch in January number, 1893, page 17.

It is only when every loose stone has become a part of the solid road-bed, that any portion of the repaired road may be called finished.

It would be a mistake to think that those are minutiæ too small to be taken into consideration. The road will be largely repaid by the economy of material and by avoiding larger repairs that would cost a great deal more than those minute cares do.

Arthur Lagron.

ASPHALT OF TRINIDAD.*

It is quite a difficult matter to say what the market price of asphalt is at Trinidad, because it is subject to so many anomalous conditions. The original cost to the government or to owners of the lands prior to the asphalt rage was substantially nothing, and the cost to those who have since purchased lands varies.

In respect to present dealers, very little, if any, pitch is sold in isolated quantities. The usual contract is for the owner or lessee of the land to deliver so much pitch at a certain price annually for a term of years. I should judge that those dealers who have contracted for La Brea land pitch within the last six months have had to pay somewhat more than the lake pitch is sold for to shippers to Europe, to wit, 28*s*. 6*d*., or $6.84 in local money, free on board.

The following itemized estimate per ton in respect to land asphalt is believed to be a fair approximation:

Price of pitch in the ground	$4 00
Digging, overlooking and cleaning	50
Carting	40
Loading lighters and loading ship	30
Lighterage from shore to ship	50
Contractor's profits, mercantile commission, and all other expenses and losses	1 10
Export duty	1 20
Freight and insurance to New York	2 25
Total	$10 25

When large quantities of asphalt are being handled or other favorable conditions intervene, this total could, of course, be reduced. It is a matter of public record, for instance, that the first cost of the asphalt taken from the pitch lake by the Trinidad Asphalt Company is only 40 cents per ton, and it can be dug more readily than the land asphalt.

I have heard it claimed that all the asphalt at La Brea is substantially one deposit, and that applying the designation of "lake" to only a portion of it is incorrect; but the only part that can be said to be like a lake is alone called the lake by the community.

The village is on an extreme point called La Brea Point; an-

* Reports from the Consuls of the United States, No. 145.

other extreme point to the east is called Point d'Or. The lake is further inland, being southwest of these points and about a mile from them, and about two-thirds of the way from Point d'Or to the opposite side of the peninsula. The lake has an elevation of 138½ feet, according to Wall and Sawkins, above high water, and on three sides the land slopes from it. It is circular in form, and covers, according to a government survey in 1886, 109 acres 9 perches, and it is believed to contain several million tons of asphalt. The geological report of Wall and Sawkins puts the maximum amount which can be expected to exist at 4,752,000 tons. Since this estimate several hundred thousand tons have been removed. The report mentions that the term "inexhaustible," applied to the lake "has probably arisen from the circumstance of artificial cavities rapidly closing up, which may have led to the supposition of the substance being reproduced or generated as fast as removed; but it is essential to remember that every pound abstracted diminishes the remaining quantity by that amount." I believe from the information I have obtained that the contents of the lake have decreased in volume within the last decade, indicating that the "supply," if it has one is not equal to the drainage that is now being made from it.

Persons who have seen a large round pond, substantially dried up, with little strips of clear water irregularly intersecting its bed, here and there patches of vegetation, and a slushy looking place near the center with fish bubbles coming up, the entire bed blackish and uninviting, can form a very fair idea of the general appearance of this famous lake. An odor described to be like that of sulphureted hydrogen gas is emitted at the sloppy looking place called the "place of supply," where many gaseous bubbles appear. In passing over the lake one will see more or less of these little bubbles, and if he stoops down and catches the odor from them he will find it the same as the odor at "the place of supply" near the center. There are also over the lake more or less little swellings of different shapes and sizes, and I am told that the smaller of them (say an inch square) contain only gas, and that some of the larger ones (say a foot square) contain both gas and decayed vegetation.

There are a large number (say two or three dozen) land islands over the lake which would probably aggregate about three or four

acres. They are covered with vegetation, and some of them support trees twenty or thirty feet high; but I am told these islands do not come up from the bottom of the lake nor do they bear down any considerable distance into the lake. Mr. J. W. McCarthy, the local manager of the Trinidad Asphalt Company, informed me that he destroyed one of them and the pitch under it rose to its own level, or the general level of the lake. A horse may be ridden on the lake and up to the "place of supply," and, under particularly favorable conditions, I am inclined to think he might be ridden through it. It is difficult to give a very satisfactory description of this particular spot, and no two descriptions of it can be exactly alike, for it is never identically the same on any two occasions. In an open space, say fifty acres or more, in which there is no vegetation whatever, may be seen a zigzag, irregularly outlined spot, which undergoes constant change in shape and size (when I was there last and took a good look at it, it was bow-shaped and approximated an acre in size). It differs from the surrounding pitch in outward appearance, as freshly molded or bright lead would differ from lead of a duller and darker hue. All of this fresher looking pitch is softer than the pitch surrounding it; but on some of it, at the more distant edges, one may walk without sinking below the heel of his shoe, and I apprehend from appearances, and was so told, that it is only a matter of time for the outer parts to become indistinguishable from the body of the surrounding pitch. Within this particular area is located what is called "the place of supply," which is one or more spots where the pitch is always softer and where, in the hotter part of the day, the pitch, or rather the water surrounding the pitch, fairly boils. These soft parts constantly shift their position, and their fomentations undergo great change, seemingly regulated by the heat of the sun. I am assured by witnesses, whose word I can not call in question, that they have seen the "place of supply" when a person could not have walked into it, both on account of the intense heat and the probability of being engulfed. I have never seen it present so terrible an aspect. On one afternoon, when it was probably in about its usual state, in the hottest part of the day, I saw a man walk into it with impunity, and it only came up to the calves of his legs. He picked up a handful of the pitch and handed it to me. It was as pliable as soft putty, and I manip-

ulated it without any of it sticking to my hands; but the water which oozed from it somewhat discolored my hands, and I was told that if I had continued the manipulation longer, till all the water oozed out, the pitch would have become sticky. Early one morning (eight or nine o'clock) I visited the "place of supply," and the man I had with me walked all over the softest spot without sinking deeper than his foot. At that time two carts containing barrels were being loaded with the "liquid pitch," and the process was to dig and pull it up with picks in lumps, which were put by hand into the barrels. I was told that in the hot part of the day the pick was dispensed with and the shovel used instead.

One of the cartmen pointed to a particular place, a foot or two square, where he said he had been digging that morning and which had filled up. The man with me stepped into this place and gradually sank nearly to his knees, but sank no further. I also noticed that this pitch, unlike that on the previous occasion referred to, stuck with considerable tenacity to the man's legs.

The little channels of water referred to constitute quite a relief to the view. These are quite clear and pretty. They vary in width; but, unless unduly swollen by rainy weather, they may be roughly estimated at two to six feet wide and, say, one foot to two feet deep, though in places the water is much wider and deeper. By these deposits of rain water the lake is divided into a great many irregular divisions. Several persons told me that it was their understanding that these little channels rose and fell with the tide, which seems unreasonable; but, as the opinion is entertained by some of the residents of the neighborhood, I submit it. The pitch comes boldly up to the water, but rarely, if ever, slopes gradually into it, but at the water's edge it is inclined to curve down abruptly, and under the water it does not promptly adhere to the pitch on the adjoining area.

It is understood that the pitch is in constant motion, and the theory has been advanced that each of these irregular divisions has a motion of its own. It would seem, from the appearances, that the water at the outer part of the pitch of the adjoining division has a very repelling effect on the advancing pitch, or else these several divisions of pitch do turn under and revolve respectively within themselves. But evidently the pitch yields in a marked de-

gree to the influences of water. I noticed a little spot of water about six feet wide, which was probably three feet deep—a depression which, if not originally caused by the settlement of water on the spot, is kept in existence by the water. In other words, the pitch would doubtless find its own level were it not for the water. I am strongly inclined to think that the "place of supply" described above, if not the source of supply or generation, is a source of general motion, the degree of motion lessening as it recedes from this center. The fact that there is a large area next around the "place of supply" on which no vegetation grows, and that (in addition to the well-defined land islands) more or less vegetation is found as you approach the border, seems to indicate that the motion near the "place of supply" is too great for sufficient earth to accumulate on the surface to support vegetation.

* * * * * * * * * * * *

As to what percentage of the entire shipments was land pitch and what percentage was lake pitch from 1851 to the present time it is impossible to tell. The facts justify the belief that prior to about 1860 nearly, if not quite, all of the pitch shipped was taken from the pitch banks at La Brea Point; but from about that time to the present the lake has furnished the bulk of the shipments. Mr. Douglas, though evidently a party to the arrangement perfected by Mr. Barber in the winter of 1879–'80, continued to work Point d'Or till June or July, 1882; and I think it quite likely, from the information I have obtained, that the Point d'Or pitch he had collected was not all shipped away before August, 1883, unless he shipped land pitch in this interim from La Cocagne, where it is alleged he continued to dig after he stopped digging at Point d'Or. But this does not exactly agree with the warden's officers' report hereinafter mentioned.

Prior to the arrangement perfected by Mr. Barber in the winter of 1879–'80, pitch was dug at a plantation called Bellevue, by the West India Shipping Company, but I am not informed as to how long a time (if any) that company continued digging there after that arrangement. I notice from the *London Shipping Gazette* and Lloyd's List of April 22, 1892, that one of the stipulations in the sale of that property by a Mr. Callender, on behalf of the West India Shipping Company, was that he (Callender) was not to ship

pitch to the United States. The numerous shipments of Mr. Douglas of Point d'Or pitch, on the other hand, from 1879 to 1882, inclusive (I did not have the harbor master's record examined for any other years), were almost exclusively to Washington, D. C.

It is proper that I should observe here that Mr. Douglas, in petitioning against an increase of the export tax in September, 1885, would seem to convey the idea by the language he used, that he had shipped 19,400 tons of asphalt from Point d'Or in the three years from 1882 to 1884. But the evidence seems conclusive that none of the pitch he shipped was dug from Point d'Or after June or July, 1882.

He was charged with obtaining pitch from the lake, which was alleged to be against the special regulations referred to, and the charge was sustained. A letter from the assistant warden (R. Johnstone), at La Brea, dated March 16, 1886, and addressed to the colonial secretary, gives a statement of an employe of the lessees of the lake, withholding his name for prudential reasons, as follows:

"Since Mr. Douglas stopped digging at Point d'Or all the asphalt he has exported has been taken from the pitch lake."

The assistant warden adds to this his own statement, as follows:

"Having had charge of that district for five years, I am in a position to bear out his statement as regards the ceasing of the digging of pitch on Point d'Or; but, being uncertain as to the year when the digging ceased, I thought it necessary to visit La Brea and gather information from those who were connected with Mr. Douglas when he carried on his business himself. With this view in mind I visited La Brea on Saturday the 13th, and ascertained that they ceased working at Point d'Or some time between June and July, 1882. This information I got from men who worked for Mr. Douglas up to the last."

It appears from one of the statements of Mr. Barber that he began using Trinidad pitch soon after July, 1878, and that he first purchased supplies from Mr. E. Burgess Warren, who had bought the same from the agents of Mr. Finlayson. I will add that Mr. Finlayson, so far as I am advised, was at that time dealing exclusively in lake pitch. Mr. Barber's statement also shows that in the spring of

1879 he bought from Mr. Douglas a cargo of *épurée* (boiled pitch). He also entered into a contract with Mr. Douglas to furnish him and his associates with pitch for a term of five years, with the option of renewing the contract twice for similar periods, being the entire term of Douglas's lease of Point d'Or. In the spring of 1879 Mr. Barber and his associates, as he states further, took a public letting at Washington city for 104,000 square yards of work "at the lowest price named by several competitors," which they completed. These circumstances, therefore, would strongly indicate that this work was done with land asphalt, as Douglas, up to that time, is believed to have shipped none other.

I think it can be stated with substantial accuracy that very little, if any, land asphalt was shipped to the United States from about August, 1883, to 1888. From 1888 to 1891, inclusive, Messrs. Thomas A. Finlayson & Co. have kept an account, and have kindly furnished me with the following figures:

TABLE SHOWING THE SHIPMENTS OF LAND ASPHALT.

Year.	United States.		Other Places.	
	Crude.	Épurée.	Crude.	Épurée.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1888	5,620	1,905	600	1
1889	11,327	2,042	.....	.....
1890	16,460	880	.....	.....
1891	10,450	.....	127	.....

The custom-house table of revenue receipts on asphalt will show (considering that the royalty, which is paid on lake asphalt exclusively, is 1*s* 8*d* per ton) that the shipments during the March quarters of 1891 and 1892 were as follows:

March quarters—	Land asphalt.	Lake asphalt.
	Tons.	*Tons.*
1891	4,050	23,454
1892	10,223	23,763

In collecting data for the preparation of this report I came across a published statement from Mr. John Cumming to the effect that land asphalt from Point d'Or and Bellevue was considered very inferior to the pure lake asphalt; and I also came across another statement from Mr. Thomas A. Finlayson, now deceased, as follows:

"The crown lands in the vicinity of the pitch lake have large deposits of pitch easily obtainable and equal in quality to the lake pitch."

These two statements are particularly interesting, inasmuch as the highly respectable firm of A. Cumming & Co., of which Mr. John Cumming is the senior partner, is now engaged as the trusted agent of Messrs. Carter, Hawley & Co., of New York, in upholding the merits of the land asphalt, while the equally reputable firm of Thomas A. Finlayson & Co. (of which Mr. Thomas A. Finlayson at the time was senior partner) is the trusted agent of the Trinidad Asphalt Company, which is in active competition against the land asphalt. * * *

I have given all the foregoing details, as this report is intended chiefly for the consideration of the various city authorities in the United States who are now considering the relative merits of lake and land asphalt in connection with the letting of contracts for making streets. With this important matter in view, I thought it best to give too much information rather than too little.

I have tried to collect all the material facts and if I have failed it has not been because I have failed to consult both sides to an active commercial controversy.

Had the department not called on me to make this report, I should probably not have undertaken to do so, for the reason, if no other, that several gentlemen of fine capabilities, some in the interest of the lake asphalt and some in the interest of land asphalt and some, probably unbiased either way, have been here from the United States investigating the subject. *W. P. Pierce, Consul.*

CURRENT INFORMATION.

MUNICIPAL ENGINEERING NEWS FROM THE NATIONAL CAPITAL.

There is probably no city in the United States where the subject of municipal engineering and city improvements generally, are attracting more interested attention than in Washington. Hardly a week passes by, but that some new question along this line is brought forward to be generally discussed on the part of the citizens.

REMOVAL OF SNOW AND ICE FROM SIDEWALKS.

The subject just now engrossing attention here is the matter of removal of snow and ice from sidewalks and gutters. Last winter being a particularly severe one in this city, resulting in considerable snow and ice, the accidents to pedestrians from slipping upon snow and ice allowed to remain too long on the sidewalks occasioned much comment and complaint in the city papers. One of the victims of the slick sidewalk was Senator Hansbrough, who forthwith proceeded to the senate and introduced a bill which was intended to forever put a stop to simliar accidents. This bill was not reached, or rather no action was taken upon it, during the last session of congress. It has now come up for action in the present session and it is possible that something will be done with it.

During the past week Colonel Ernst has forwarded through Senator Casey and Assistant Secretary of War Grant, his report on this bill. He suggests that with an amendment making the provisions of the bill refer to "paved" sidewalks the first three sections would seem to be in the interest of good government. The section requiring the district commissioners to keep the cross-walks and gutters clear is changed so that the cross-walks shall be cleared to a width of ten feet, and when covered with ice, sprinkled with sand, sawdust or such material as will insure safety to pedestrians. The duties of the government regarding the care of sidewalks about public buildings and through public squares and parks are amended so that the work of cleaning the snow away is to begin after and not upon the commencement of a storm. Only such walks in parks as are thoroughfares shall be cleaned to a width sufficient to accommodate the public, and this is to be done only when funds are available. The communication closes: "It may be proper to remark in this connection that the appropriations for the removal of snow and ice have habitually been less by 20 per cent. than the estimates submitted by this office."

The recommendations submitted by Colonel Ernst are endorsed both by General Casey and Assistant Secretary of War Grant.

A DEMAND FOR BETTER SEWERAGE.

Another municipal question that during the next few months will command much attention here will be the demand for better sewerage. Several times recently communica-

tions have appeared in the city papers in reference to this subject, and additional interest has been shown by the protests of the most prominent physicians of the city in regard to this matter, and which appeared in an evening paper over their own signatures.

It is a generally accepted fact that grave defects exist in the Washington sewerage system, and some radical and positive measures are demanded to remedy a condition that no other community in the country would be likely to allow for an instant. The physicians whose letter was above referred to, are unanimously of the opinion that Washington is in danger of cholera with this city's present frightful sewerage and drainage defects.

Plan after plan for proper sewerage and drainage have been presented, yet nothing has been done, or at least no action taken as yet. The officials are willing to do something, but have no means at their command, as they require the necessary appropriations from Congress to carry on the work that concerns vitally the National Legislators, as well as the community itself. Some of them are beginning to pause to think of the sanitary conditions of the buildings they occupy or visit, that are now without proper drainage. A prominent physician of this city said a few days ago: "It is folly to think of putting a house in a sanitary condition without proper and certain drainage. The silver mounted fixings in plumbing houses may be compared to the silver mounted coffins, both gilded receptacles of disease and death."

TESTS OF ASPHALTS AND CEMENTS.

The inspector of asphalt and cement has made a very interesting annual report to the District Commissioners of the affairs of his office. During the past year he was sent to the Island of Trinidad, from which nearly, if not all, the asphalt used in the District is obtained. He has continued his laboratory tests, and some new features have been introduced, and careful studies made of the nature and applicability of asphalts and cements.

The Commissioners of the District have accepted the proposal of the Schillinger Paving and Curbing Company to improve 18th street from S street to the boundary.

IMPORTATIONS OF ASPHALT.

The official records of the customs division of the Treasury Department for the month of October, the latest period for which statistics have been completed, reveal some interesting facts pertaining to the imports and exports of crude asphaltum lines, during that month, and through the courtesy of treasury officials, your correspondent is permitted to glean the following facts:

During the month of October there was imported into the United States, free of duty, 9,644 tons of asphaltum, valued at $20,585, which is a considerable increase over the imports of the same month last year, when 2,465 tons were imported, at a valuation amounting to $11,291. The imports for the ten months ending with October, reached 85,473 tons, or $302,105 worth, against 70,101 tons during the corresponding period of 1891, and representing a valuation of $239,891.

There were no re-exports of asphalt in October, but during the ten months ending with that month the shipments amounted to 84 tons, or $2,513 worth. During the same period last year a much larger busi-

ness was done in re-exporting, there being 398 tons shipped out at a value of $4,530.

IMPORTATIONS OF CEMENT.

The imports of cement upon which a duty was paid, reached in October 129,399,235 pounds, valued at 447,169 against 116,727,669 pounds imported in October, 1891, at a valuation of $422,858. For the ten months ending with October these imports amounted to 831,283,460 pounds, worth $2,881,283, which is not quite up to the imports of the corresponding period of 1891, when 1,001,768,795 pounds were brought into this country at a valuation of $3,704,476.

The re-exports of cement in October amounted to 1,289,125 pounds, worth $4,590, which indicates a considerable growth of business over the outgoing shipments of October last year, when 75,694 pounds were re-exported, at a valuation of only $252. The re-exports for the ten months ending with October are almost double that of the corresponding period in 1891, being 6,334,201 pounds, worth $24,197, against 3,342,730 pounds, valued at $14,372. *Egbert Earle.*

Washington, Jan. 15, 1893.

LEGISLATION REQUIRING BETTER GAS LIGHT.

The congressional appropriation committee has taken an important action in the direction of an improvement in the quality of gas that has been furnished consumers in this city. Serious complaints have been made from time to time, and the matter was referred to the Commissioners of the District, who recommended legislation, which will be incorporated into the appropriation bill as follows:

That for securing a better fulfillment of the intent of the act entitled "An act regulating gas works," approved June 23, 1874, two additional laboratories shall be provided and fitted up by the Washington Gas Light Company, subject to the approval of the Commissioners of the District of Columbia, and shall be furnished with suitable apparatus, to the satisfaction of the said commissioners for inspecting and testing the illuminating gas manufactured and distributed by the said Washington Gas Light Company and the gas meters used for measuring the gas supplied to consumers by the said Washington Gas Light Company. One of the said laboratories shall be located in the northwestern portion of the city of Washington and the other in the southeastern portion of said city, and the cost of providing and fitting up the said laboratories shall be paid for by the said Washington Gas Light Company. And for securing the better fulfillment of the intent of the said act, a laboratory shall be provided and fitted up by the Georgetown Gas Light Company, subject to the approval of the Commissioners of the District of Columbia, and shall be furnished with suitable apparatus, to the satisfaction of the said commissioners for inspecting and testing the illuminating gas manufactured and distributed by the said Georgetown Gas Light Company, and the gas meters used for measuring the gas supplied to consumers by the said Georgetown Gas Light Company; provided, that the cost of providing and fitting up the said laboratory shall be paid by the said Georgetown Gas Light Company, and the said Georgetown Gas Light Company shall be liable for such penalties for departures from

the standards of illuminating power and purity of the gas manufactured and distributed by the said company as are prescribed in the first section of the said act entitled "An Act Regulating Gas Works," approved June 23, 1874.

Provided, further, that the provisions and penalties of the act entitled, "An act to authorize the appointment of an inspector of plumbing in the District of Columbia, and for other purposes," approved April 23, 1892, are hereby extended to include the practice of the business of gas fitting in the District of Columbia. Provided further, that the Washington Gas Light Company and the Georgetown Gas Light Company shall, at the beginning of each fiscal year, in proportion to their respective sales of gas for the fiscal year immediately preceding, provide in advance by depositing with the collector of taxes of the District of Columbia, a sum sufficient to pay the salary of an inspector of gas fitting, to be appointed by the Commissioners of the District of Columbia, at $1,000 per annum, and also the necessary expenses of maintaining the service of inspecting and testing illuminating gas and gas meters, as estimated by the Commissioners of the District of Columbia.

Provided further, That the daily inspections prescribed in section 5 of the act entitled, "An act regulating gas works," approved June 23, 1874, shall hereafter be made at any time after 12 o'clock, noon, and before 12 o'clock, midnight, in the discretion of the inspector of gas and meters.

Provided further, That the provisions of sections 7 and 8 of the act entitled, "An act regulating gas works," approved June 23, 1874, shall hereafter apply to all gas meters from which the heads shall have been removed by any gas company in the District of Columbia for the purpose of examining and repairing the same, and no gas meter from which the head shall have been removed shall again be placed in service by any gas company in the District of Columbia without having been duly inspected, approved and sealed, as provided for in said act.

During the recent excessively cold weather complaints concerning the inferior quality of gas have been greater than usual, so much so that the matter has been brought before congress, and Senator McMillan, chairman of the district committee, has been authorized to investigate as to whether there is ground for the complaints which have been made with regard to the price and quality of gas in this city. Mr. Ford, the United States inspector of gas here expresses the opinion that a better quality of gas is now being furnished than was the case some time ago. He said that the gas company in this city had recently completed putting in an improved process for making water gas, which he thought had resulted in a better article. In his opinion the difficulty which caused the complaints arose from the condensations in the pipe stopping them up, and preventing the free flow of gas. He suggested to the engineer of the company that perhaps the proportion of the mixture of coal gas with water gas was too great, and that the supply might be enriched by using more of the water gas. The proportion observed by the company was two-thirds coal gas and one-third water gas.

Not only has there been much complaint regarding the quality of gas in Washington, but there has

been much vigorous remonstrance against the price being paid here, and the end is not yet.

A. I. P.

Washington, Jan. 17.

RAPID TRANSIT IN NEW YORK.

The recent attempt to sell at public auction the franchise for rapid transit under Broadway and other streets in New York for a period of 999 years, as laid out by the Board of Rapid Transit Railroad Commissioners, was a failure. There was but one bid of $1,000.

That the careful work of five conscientious business men for many months, under the advice of the ablest engineers of modern times, and in a direction which the logic of the times has demonstrated to be imperative, should come to this most ignominious end has been deplored by all, but that the commission itself, certain of its ground from an engineering standpoint, should consider the project a failure, and its own work impracticable, seems almost inexplicable. If the engineering questions had been satisfactorily settled, as is maintained, the fault must lie with the terms of sale. These the commissioners reserved the right to modify as expressly stated in section 17, which reads: "The Board of Rapid Transit Railroad Commissioners reserves to itself the right to reject all bids and readvertise the said rights, privileges and franchises for sale under the same or *different* terms of sale, as often as it may deem necessary in the interest of the city of New York," etc.

After the result of the terms of sale had been realized a meeting of those vitally interested in rapid transit was held at the Real Estate Exchange to devise ways and means out of the dilemma. This was on January 5. A set of resolutions was then declared passed in favor of asking the city to build the underground road herself. But there was a large number who dissented from these views, and who claimed that they had been counted out by the chairman. These, immediately upon adjournment, called another meeting on the spot. Excitement grew apace and crimination followed crimination. Finally upon order being measurably restored, a sub-committee was appointed by the dissenters to draw up and present to the commissioners a set of resolutions adverse to the municipal scheme, and favoring the extension of the present elevated railroad system.

These two committees appeared in open meeting before the commissioners, each claiming to represent fairly the real estate interests, and each denying that the other did so represent them. One faction argued that the city should undertake the underground system, and the other that the plan should be abandoned as impracticable and and that the elevated system should be extended. But no action has yet been taken.

Some of the daily papers and many of the public look upon the whole thing as a fight between two interests, viz: Tammany and the Manhattan Railway Company, and some are so uncharitable as to state their belief that the terms of sale were purposely made prohibitive with the view of advancing either one or the other interest, and that it was never the intention that private capital should take hold of the enterprise.

A. I. C.

FLOOD WAVES IN SEWERS.

At the meeting on January 4th, of the American Society of Civil Engineers, a paper by A. J. Grover, on "Flood Waves in Sewers, and their Automatic Measurement," was read by the Secretary.

The experiments were made at Omaha, Nebraska, and the rainfall was also recorded. The rain gage employed was a modification of that of the United States Weather Bureau. There were two tops 0.8 inch diameter, the water from one being carried to a cylinder in which it was measured directly by a stick gage, and the water from the other going to an apparatus by means of which a continuous record was made automatically. The sewer gage consisted of a galvanized iron boat 3 feet long, 1 foot wide and 6 inches deep, held in place near a manhole, but with entire freedom to rise and fall. This carried a longitudinal shaft on which at the stern of the boat was a screw 18 inches diameter. The flow of the sewage caused this to revolve, and, by means of gearing, the motion was transmitted to an electric key and recorded. The rise and fall of the boat was also recorded. A storm shield was employed to prevent damage to the apparatus in case of an excessive flood.

The gage was fixed in an 8½ foot circular sewer, which drained 2,100 acres. The longest dimension of this area was 11,000 feet, and the slopes varied from less than 1 per cent. to 18 per cent. The sewers were not well proportioned for the work to be done, and at the junction of the two mains there was a constant flooding. About 150 feet below the gage the sewer was changed in form to a semi-elliptic invert, 16x5 feet, covered with steel beams. The grade at, and for 418 feet above the gage is .0057 to 1. There were 40,000 people in the district, which at 100 gallons per head would make 53.333 cubic feet per day, to which springs along the line added somewhat. Two large breweries, a number of factotories, etc., discharged into the sewer.

With a rainfall of 0.77 inches, 0.3 of which came in ten minutes, the summit of the flood was reached in eleven minutes after the dash was over. With a rainfall of 0.2 inches falling steadily for thirty minutes on the 2.100 acres, the summit of the wave will be at the mouth of the sewer when the rain ceases. In a subsequent rain coming in three dashes, as many distinct fluctuations where shown in the sewer, following quickly the successive falls of rain. A daily normal flow-sheet shows the relative daily velocity of the sewage and illustrates the regularity and precision of the gage, the noon stop of factories and elevators, and the greater use of water on Saturday, Monday and Tuesday.

STREET RAILWAY STATISTICS.

Statistics compiled by the *Street Railway Journal* show that the mileage of electric railways exceeds that of all other street railways combined, although only a little over one-third the cars operated are credited to electric roads. This may be in part due to the reporting of cars used as trailers on electric and cable lines under the head of horse cars; but it is also largely due to the great number of horse cars still running in the cities of New York, Philadelphia and Chicago.

The enormous increase in electric railways in 1892, amounting to 1,878 miles of railway and 4,523

cars, is of course the most striking fact shown by the table. The construction of electric street roads is seen to be nearly half as great in mileage as the construction of extensions to steam railways. Considering the investment in central stations and electric plant and the comparatively cheap work done on many of the steam railway extensions, it is probable that the investment in electric railway extensions has not been far inferior to that in steam railway extensions during the past year. Horse railways are showing a great falling off, in both mileage and cars, and the few steam tramways or "dummy lines" are, on the whole, decreasing. Cable lines increased fifty-two miles.

The total number of cars in use on street railway lines has reached the large figure of 38,400, which is nearly 15,000 in excess of the number of passenger cars in steam railway service. Comparing the two systems of transportation by the relation between cars and mileage, the street railways have 331 cars per one hundred miles of line, while the steam railways have only 17.

DATA REGARDING A MISSISSIPPI RIVER BRIDGE.

The annual election of the Civil Engineers' Society, of St. Paul, on January 9, resulted as follows: President, George L. Wilson; vice-president, J. D. E. Stabrook; secretary, C. L. Annan; treasurer, A. O. Powell; librarian, A. Munster; representative on the board of managers of the Association of Engineering Societies, C. J. A. Morris. The president-elect made the following appointments for the ensuing year: Examining board: C. F. Loweth, A. O. Powell and E. E. Woodman; auditor of accounts of 1892, W. C. Merryman.

Mr. Joseph S. Sewall, Member American Society Civil Engineers, designer and engineer in charge of construction of the bridge over the Mississippi river, connecting Marshall avenue, in St. Paul, with Lake street, in Minneapolis, informally presented some interesting data concerning that structure. The bridge consists of two principal iron-arch spans of 456 feet each, and its total length is 1,273 feet. A twenty-foot roadway is laid on 7x16 wooden stringers and is designed to admit the passage of a fifteen-ton road roller. There is a five-foot sidewalk on either side. The appropriation was limited to $150,000, and was to cover all preliminaries. The cost of the sub-structure, abutments resting on sand rock and pier on gravel, was $32,360; superstructure $109,100. Portland cement was used in freezing weather only. Work was begun in October 1887, and finished in May 1889, considerable delay being caused by non-arrival of material.

C. L. Annan, Secretary.

NATIONAL MEETING OF BRICK MANUFACTURERS.

The annual meeting of the National Brick Manufacturers' Association at Louisville, beginning on January 24th, was largely attended. Following the annual address of President Pearson, reports were submitted by the Secretary and Treasurer. Following the precedent of electing as President a representative of the city in which the convention was held, Mr. A.L. McDonald was put in nomination. With a view to breaking the line of precedent he declined the nomination and proposed Anthony Ittner, of St. Louis, who was elected. The other officers elected were First

Vice-President, A. L. McDonald, Louisville; Second Vice-President, W. P. Gates, Chicago; Third Vice-President, B.W. Blair, Cincinnati; Recording Secretary, C. P. Merwin, North Haven, Conn.; Corresponding Secretary, T. A. Randall, Indianapolis; Treasurer, John W. Sibley, Alabama. Wednesday night the annual banquet was given at the Galt House, with J. P. McCullum as master of ceremonies. Brief addresses were made by Messrs. Ittner, Gates, McDonald, Purington, Adams, Blaffar, Alty, Merriweather, Pinger, Eudaly and others. At the sessions on Wednesday and Thursday, the programme of papers as outlined was carried out, among the features being an address on "Vitrified Brick," by Capt W. S. Williams, of Canton, O., which will be published in PAVING AND MUNICIPAL ENGINEERING hereafter, a paper on "The Manufacture of Brick from Shale by the Dry Press Process," by J. R. Figh, of Dallas, Tex., and "The Evolution of the Brick Machine," by Cyrus Chambers, of Philadelphia.

SOME RECENT INVENTIONS.

A Paving Brick, by L. C. Turley, Portsmouth, Ohio, is of a rectangular shape with a plain top, bottom and ends, and has a longitudinal recess in its face and a corresponding interlocking rib on the other, with a series of welts in relief on one of said faces.

A Portable Bridge, by Lewis Barnes, assignor to William A. Nichols, Wayne, Pa., which is intended for ditches at or beneath the surface of the ground. The chief novel feature is in the attachment to the ends of the bridges of wings formed of sills, stringers and brace pieces. The object of the wings on each side at the end of the bridge seems to be to prevent the ground at that point from being washed away.

A Pipe Coupling, by William R. England, Chicago, Ill., consists of one member being provided with a longitudinally - corrugated spigot and another member having an interiorly - longitudinally - corrugated bell, the corrugated portions of the spigot and bell interfitting with each other, and about them is an angular chamber for packing.

A Machine for Making and Repairing Roads, by Martin G. Bunnell, assignor to Frederick C. Austin, Chicago, Ill., consists of a four-wheeled carriage with the front and rear wheels far apart and a frame between supporting a scraper adjustably. The frame is adjusted vertically or laterally by a lever, the rear wheels are shifted laterally by the use of a hand wheel and chain, and the vertical angle of the scraper is adjusted by the use of another hand wheel. Two men are required to operate it, one to drive and one to guide and adjust the machine.

A Street Crossing, by George W. Doolittle, Chicago, Ill., consisting of a U-shaped trough extending across a street, with metal plates resting on the upper edges of said trough level with the street and having a closely arranged series of serpentine ribs provided with edge notches and grooves between the ribs having their bottoms inclined in opposite directions to the transverse openings through which any water may pass.

A Bridge Gate, by Eugene Delia, Chicago, Ill., consisting of the combination with the bridge approach or abutment of an extensible gate secured at one end to a

fixed post of the abutment and at its other end having a latch and traveling on a caster or a wheel, whereby the gate closes automatically and is provided with the usual means of opening the gate.

A Pavement, by Benjamin F. Spry, Des Moines, Ia., is composed of pieces or strips with grooves in their side faces and separately set on edge on a road bed so as to extend transversely across the road and parallel to each other, and solid blocks corresponding in length with the width of the said parallel pieces, and having ribs on their side faces adapted to enter the grooves in the cross pieces. After thus formed a composite filling material is put in the vacant spaces between the blocks and cross pieces. These cross pieces may, if desired, extend diagonally from the side to the middle of the street.

An Artificial Stone, by Hermann Endemann, assignor to the American Carbonate Company, N. Y., consisting of magnesia, magnesia hydrate, and basic oxalate of magnesia and sand. It is prepared by mixing magnesia, oxalic acid and water, and after allowing the mass to harden, to expose the same to the action of an oxalate.

A Wheeled Excavator aed Carrier, by Marcus E. Cook, Wallingford, Conn., has an arched frame mounted on trucks, a scoop being suspended from such frame by a mechanism which is adjustable and can be so operated by a lever as to hold the scoop in any desired position.

A Border for Walks, by James E. Chapman, of San Jose, Cal., consists of vertical curb sections with exterior and interior vertical corrugations and a base, the bottom of which extends outwardly at right-angles with the vertical portion, the upper surface meeting the outer vertical surface at an angle greater than a right angle, and having corrugations formed therein in continuation with the corrugations in the exterior face of the vertical portion. *V. H. Lockwood*,

Patent Attorney.

Indianapolis.

LEGAL DECISIONS.

Use of Highways for Water Mains—The laying of pipes and hydrants as authorized by the New York law, by a private corporation, in the highways of an unincorporated village, for the purpose of supplying the inhabitants with water, all of the inhabitants being entitled to the use thereof on the payment of a reasonable rate, is for a public use, even though no contract is or could be made with the municipality to supply it with water, and the highways may be so used on obtaining a permit from the village, as provided by the law. The fact that the village is unincorporated, and no contract can be made with it to supply it with water, and that the company cannot, therefore, exercise the right of eminent domain, is immaterial, since the right to so use the highways is not based on the right to condemn property, but on the doctrine applicable to the use of urban highways for such purposes. Such use of the highway does not impose an additional burden on the fee, for which the abutting owners are entitled to compensation. Witcher *v.* Holland Water-Works Co., Supr. Ct. of N. Y., 20 N. Y. Sup. 561.

Liability for Improper Sewer Construction.—Under the California statute providing that the superintendent of streets shall give bonds on which, if he fails to see the laws, ordinances, orders and regulations

relative to streets or highways executed, after notice of violation thereof he shall be liable to any one injured in person or property in consequence of his official neglect; and section 11, providing that all persons directly interested in any work provided for in the act, feeling aggrieved by any act or determination of the superintendent relative thereto, shall appeal to the city council, and further providing that all the decisions of the city council shall in certain respects be final; the remedy of one complaining of the superintendent's neglect in not seeing that a sewer was properly constructed in accordance with specifications, is not confined to appeal, and there having been none he can not sue on the bond. Goodsell *v.* Ashworth, Supreme Court of Cal., 31 Pac. Rep. 261.

Specific Enforcement of Filtration Contract by Water Company.—Where a water company, under its contract with a city giving it an exclusive franchise, has established its plant, laid its water pipes in the streets, and private consumers have, at large expense, conducted the water into their houses, a provision of the contract making it the duty of the company to filter the water intended for domestic use, will be especially enforced at the suit of the city, as an action for damages by the private consumers would be wholly inadequate, and a forfeiture of the exclusive franchise of the company would entail on the city the needless expense of erecting new works. The fact that the company, under its contract, has the right to pump unfiltered water through its pipes in case of fire, does not excuse it from its failure to filter the water at other times. The fact that a filter put in by the company was adequate when its works were constructed, does not excuse it from putting in a new one after the old has become inadequate by reason of the city's growth, and the consequent increase in the demand for water. The fact that the city may have delayed in applying taxes raised by it to the payment of the interest and principal of the company's bond, as required by the contract, and that it ordered the company to lay pipes where they were not required, will not defeat its action for specific performance; it appearing that all taxes had eventually been applied as provided for in the contract, and that the city had not insisted on compliance with its order respecting the laying of pipes. City of Burlington *v.* Burlington Water Co. Supr. Ct. of Iowa, 53 N. W. Rep. 246.

Fire Liability Can Not be Contracted Away.—The Iowa statute provides that "any corporation operating a railway shall be liable for damages by fire that is set out or caused by operating such railway"; and another section provides that a common carrier can not exempt itself from liability as such carrier by contract. A contract between the owner and operator of an elevator, coal shed, and corn-cribs, and a railroad company, exempting such company from liability for damages by fire negligently set by its engine, is void, where it appears that such buildings were built and used for the purpose of promoting the business of such railway company. Griswold *v.* Illinois Central Ry. Co. Supr. Ct. of Iowa, 53 N. W. Rep. 294.

Liability for Bridge Breaking Under Threshing Outfit.—In an action against a county for an injury to a team and threshing outfit, caused by the breaking of a bridge while attempting to drive

across it, is for the jury to determine whether the use which was being made of the bridge was unusual and extraordinary, and such as the county was not bound to anticipate; and a verdict in favor of the owner will not be disturbed on the ground that such use was improper. It can not be said, as a matter of law, that the use which was being made of the bridge was unusual and extraordinary, and such as the county board was not bound to anticipate. Such machines are in common use, and of necessity are frequently moved along the highways and across the bridges of the county. Their passage is not so frequent as vehicles in more common use, but the same is true of four- and six-horse teams, and yet a court would not declare, as a matter of law, that the passage of such was not to be anticipated. Yordy *v.* Marshall County, Supreme Court of Iowa, 33 N. W. Rep. 208.

Appropriation of Water.—Where a person constructs and maintains a dam in a stream on public lands for the purpose of supplying a canal with water to be used for beneficial purposes, he acquires a possessory interest in the dam, the pond formed by it, and the land under the pond, and others will be enjoined from extending a canal into the pond, even though their intention is to take only the surplus water after the former's canal has taken its supply. Natoma Water & Min. Co. *v.* Hancock, Supreme Court of California, 31 Pac. Rep. 112.

LAYING A WATER-WORKS INTAKE IN LAKE SEBAGO.

A 48-inch cast iron water-works intake was recently laid beneath Lake Sebago, by the Portland, (Me.) Water Company. The pipe was put together on shore, with heavy leaded joints. The two ends of the line of pipe were stopped, and the pipe rolled over sticks into the lake, being checked at four points with wire cables and pulleys. A small tug towed the pipe for two miles to a trench which had been dredged for it in the bed of the lake. The water was quiet but there was more tendency to lateral bending of the line than had been expected, the rigidity of the line depending upon lead joints.

At the outer end of the pipe a T joint was placed. In sinking, the outer end of the pipe reached the bottom in 15 or 18 feet of water, while the 314 feet nearest the shore remained at the surface, thus the outer 136 feet bent to a curve. When the pipe was in this position the shore end lacked about 12 inches of making a junction, but in grounding in the trench the pipe moved to within 4 inches of the pipe in the gate house and a joint was made with a sleeve.

COST OF A COLORADO SEWER.

The cost of a 16-inch vitrified pipe outlet sewer, 7,100 feet long, recently completed by contract at Trinidad, Col., is given by Mr. Norval W. Wall, City Engineer, as follows: The total cost was $11,263.

The price per lineal foot was $1.48, not including extras. The contract price for masonry was $5 per cubic yard; for solid rock excavation, "extra from earth excavation," $2.50 per yard; for nine manholes, $35 each; for twelve inspection pipes, $8 each; for lumber, 2 cents per foot, B. M. The average cut was 6.4 feet.

A siphon of 16 inch cast iron pipe, about 115 feet long, was laid

beneath the Las Animas river, in a shallow trench, for $605. The pipe was three-quarters of an inch thick, with ordinary lead joints. At each end of the siphon there was a Trinidad sandstone manhole, laid up in Portland cement mortar, 4 feet square, one 12 1-3 and the other 10 1-3 feet deep, with concrete foundations and bottoms. These manholes cost $507. The cost of the siphon and manholes is not included in the total for the outlet sewer.

GRANITE OF GREAT CRUSHING STRENGTH.

The crushing strength of granite, the strongest of building stones, is commonly rated at 12,000 to 15,000 pounds per square inch, when tested in two-inch cubes, and only the hardest and toughest of the commonly used varieties reach a strength above 20,000 pounds. Recently, however, a granite quarry has been opened on the Connecticut river, the product of which shows a crushing strength averaging some 30,000 pounds, or nearly double that of the average granite in the market. Samples of this stone tested at the Watertown Arsenal have shown a maximum ultimate strength of 35,965 pounds per square inch.

PAVING BRICK IN GLASGOW.

Brick paving is to be tried in Glasgow. It is in common use in some Continental towns, but the difficulty of procuring the right kind of material in England for the manufacture of bricks of a sufficient hardness and toughness has prevented that form of paving being tried. Proper material has, it is said, now been found near Braidwood, and the bricks are to be manufactured by the Omoa Fireclay Co., which is erecting new works for the purpose. While the material is called a clay, it is in reality an imperfect hematite ore, and requires to be quarried.

DURABILITY OF ASPHALT PAVEMENTS.

Some new and interesting facts bearing upon the relative durability of asphalt and granite pavements are given in the full-page advertisement of the Warren-Scharf Asphalt Paving Company, which those who are interested in pavements will do well to read.

PERSONALS.

Mr. A. R. Turner, Jr., chairman of the water board of Malden, Mass., has resigned.

Mr. Chas. D. Colson has been appointed water commissioner of Holyoke, Mass., for three years.

Mr. Harry Goldmark has opened an office in the Rialto Building, Chicago, Ill., for practice as civil engineer.

Prof. R. H. Thurston, of Cornell University, has been appointed a member of the advisory council of engineering and marine architecture at the World's Fair.

Mr. F. A. McClure has been reelected city engineer of Worcester, Mass. Mr. John S. Brady has been elected water commissioner, and Mr. H. B. Eddy superintendent of sewers.

Mr. Charles Hubbard has been reappointed a member of the board of water commissioners of Syracuse, N. Y., for the term of six years. Mr. Wm. B. Cogswell has been appointed for the unexpired term of Mr. Peter B. McLennan, resigned.

Mr. W. Barstow, of the Brooklyn Edison Electric Light Company, has gone to London and Paris to investigate the electric light plants of those cities in the interests of his company.

Mr. H. P. Bradford, who has been manager of the electric street railways in Little Rock, Ark., for a long period, has been appointed manager of the Mt. Auburn electric road in Cincinnati, O.

Mr. Rudolph Hering, of New York, the well known sanitary engineer, has been appointed consulting engineer for the sewerage system of Washington, D. C., and the District of Columbia.

Mr. A. B. Ellsworth, Jun. Am. Soc. C. E., died Jan. 10. He was a member of the firm of Ellsworth Bros., civil engineers and surveyors, Buffalo, N. Y.; was a graduate of the Massachusetts Institute of Technology, and for three years prior to April last was resident engineer for a Pittsburg testing laboratory, at Athens, Pa.

Mr. Thomas Sedgwick, M. Am. Soc. C. E., San Diego, Cal., has been appointed by the mayor to fill the vacancy in the board of water commissioners of that city occasioned by the resignation of Mr. T. Shaw.

The annual meeting of the Connecticut Association of Civil Engineers and Surveyors was held at Hartford, Jan. 10. Officers were elected as follows: President, E. P. Augur; vice-presidents, F. W. La Forge and W. G. Smith; secretary and treasurer, W. B. Palmer; executive committee, E. P. Augur, C. H. Bunce, B. H. Hull and F. W. La Forge.

The Western Society of Engineers, at its annual meeting and banquet, held in Chicago in January, elected the following officers for the coming year: President, Robt. W. Hunt; first vice-president, R. A. Rust; second vice-president, H. B. Herr; secretary and librarian, John W. Weston; treasurer, E. G. Nourse; trustee, Geo. S. Morison.

LETTERS FOR THE PUBLIC.

FOUNDATIONS FOR BRICK STREET PAVEMENTS.

To the Editor of Paving and Municipal Engineering:

SIR—I read with some interest Mr. Whitten s article on "Foundations and Construction of Brick Pavements." I am of the opinion that there can be no set rule for the construction of foundations that will be satisfactory in all localities. I think that every city must decide on what will make the best foundation, from the nature of its sub-soil. A rolled gravel foundation might meet all the desired wants in one place and be a failure in another. I also believe it possible to make a poor foundation out of concrete and a good one out of gravel or stone. It is *not* so much a matter of what a foundation is made of as how it is made. I know that some of the smaller cities in Indiana will be dissatisfied with their brick streets and stone foundations, for the simple reason that they were not made right. A five-ton horse roller is not heavy enough to roll eight inches of crushed stone, and you can not make a solid surface upon crushed stone without covering it

with an inch of coarse gravel before rolling. Those who have made these foundations have rolled directly upon the stone and used too fine a sand for making the surface for the brick. As the sand dries it sifts down into the stone, and the pavement follows it, and results in a rough pavement, which could be obviated by the use of a gravel coating, thorough rolling and using coarse sand.

I can not see the merit of laying brick at an angle of forty-five degrees. Even though it saved some in wearing qualities, it makes it much harder for a horse to get firm footing when starting a heavy load, and that is the very reason we lay them at an angle in intersections. It keeps the wagon at right angles with the brick, while making a turn, and insures the horse a firm footing. Another virtue claimed for laying them at right angles with the curb is that the bearing of wheels is distributed over the greatest number of brick, the bearing never being on one or two bricks, but four or five.

Columbus has built a great deal of brick paving, and has done considerable experimenting, and the result is to use one course of brick, well-rolled stone foundation, brick laid at right angle with curb and forty-five degrees at intersections, and tar filling. *F. W. Cerny.*

Columbus, O., Jan. 24, 1893.

AMERICAN ASPHALT PAVING IN PARIS.

To the Editor of Paving and Municipal Engineering:

SIR—In your last issue I find a letter from W. H. Delano, of Paris, replying to my "Classification of Asphalts" in your issue of November last.

I don't wish to say anything more regarding it, as it is impossible to convince those who do not wish to be convinced, and leave the judgment to the intelligent readers of your valuable magazine.

The letter of Professor De Smedt, appearing also in your last issue, is very conclusive in regard to the error of those two gentlemen, Malo and Delano. In regard to other points, I wish to say, "People who live in glass houses should not throw stones."

Mr. Delano may never have seen your correspondent, Louis H. Gibson, but he, Mr. D., took good care that your correspondent received all information, some true and some not true, in order to write some disparaging reports about the American asphalt, and lauding up the French asphalt. Mr. Gibson having no knowledge about asphalt and asphalt streets, reported as informed, and his article, being so extremely unjust to the American company, who laid the asphalt in Paris, I replied to it, because I know all about the laying and breaking up of the pavement in Paris.

I never have denied that I superintended the laying of the American asphalt in Paris. I affirm, I did, and furthermore, I say, the enormous traffic on Rue de Rivoli broke it up.

In the same year, 1886, Mr. Delano laid, with his Seyssel rock asphalt, a piece of Rue de Rivoli, along Hotel de Ville and Place de Hotel de Ville, up to Rue du Renard, abutting American asphalt at Rue Lobau. This piece of Rue de Rivoli was far better located and more suitable for asphalt than the piece the American company laid, which last piece Mr. Delano had refused to lay. Mr. Delano had no tramway to contend with, yet the

piece required numerous repairs in the first winter; in fact, during all the time I had the time to examine it, and I believe, had it been laid by a foreign company, it would have been condemned entirely.

Mr. Delano, although he claims to know so much about asphalt, has yet, like myself, a great deal to learn.

The figures of the amount of asphalt laid in the principal cities of Europe, given by Mr. Delano, are certainly exaggerated, and he forgets to mention that his company laid, probably, only one-fifth of the total.

Please correct the misprints in my article, "Classification of Asphalt," on page 153 of last November issue. In the middle of the last column you state "Sivilian" and "Gimmer" instead of "Sicilian" and "Limmer."

Julius Schubert.

New York, Jan. 25, 1893.

SELECTIONS FROM THE PRESS.

ELECTRIC RAILWAY BUILDING.

The past year has seen a great number of the street railways using horse power equipped electrically, so that as matters now stand it would look as though electric railway building during the coming twelve months would be to a large extent in the direction of building and equipping new roads; and, judging from the present indications, many of the new roads, particularly in the more thickly settled portions of the country, will be either suburban or interurban roads, thus giving the actual competition with steam roads that has been threatened.

A feature in connection with the building of electric railways which is worthy of passing mention is that of the company furnishing the apparatus, also furnishing money with which to buy out established lines, consolidate them and increase their earning capacity. The larger electrical companies seem to be doing considerable of this both with railway and light companies. The American Bell Telephone Company inaugurated a similar plan in the early days of establishing telephone exchanges. Afterward it disposed of some of its holdings of such securities, but they developed into such good investments that in many instances it purchased them back again at a decided advance in price. The holdings of many electrical manufacturing companies in light stations and street railways will in the same way very likely prove paying investments.—*Electrical Industries.*

THE TROLLEY AND INSURANCE RATES.

It seems hardly probable that the introduction of the trolley road in an outlying, sparsely settled part of this city should be the cause of a raising of the insurance rates over the whole city of New York, though the announcement that such a raise has been determined upon by the Board of Fire Underwriters followed almost immediately the report that the trolley franchise had been granted. The fire insurance premiums paid in this city amount to over $7,000,000 annually, even only a slight raise of which is no

small burden on an already overtaxed community. But as a rise in insurance rates has followed the trolley in Boston, Brooklyn and New York, even though seemingly unjust, companies introducing electric railways will find it greatly to their interest to give their very best attention to making the trolley wire absolutely safe, even at considerable expense, against being crossed. —*Electrical World.*

INCREASED EARNINGS OF RAPID TRANSIT.

So much has been written on what a change from horse to mechanical power will accomplish readers are apt to accept the statement, but neglect to notice in how marked a degree is the resulting increase.

The Binghamton, N. Y., street railway is a good example of the above, and the more so because it is not one of the larger roads. This road shows the following wonderful increase in the past three years: Gross earnings year ending Sept. 30, 1892, $12,163.40; gross earnings year ending Sept. 30, 1892, $52,240.33; gain for July, August and September, 1891, over 1890, $4,621.05; gain for July, August and September, 1892, over 1891, $5,008.14. Showing a total gain of this period of three months of 1892 over 1890 of $9,629.19, the same being a gain of 73 per cent. and with the same track mileage and local conditions.

The earnings shown for year ending Sept. 30, 1892, were made with ten miles of the system operated by electricity; the balance by horse power. The remaining 3½ miles have been electrically equipped by the Binghamton Railroad Company since consolidation, and operation commenced Oct. 13, '92, and with the same number of cars (three) for the first four weeks earned, viz.: Oct. 13 to Nov. 9, '92, electricity (3 cars), $1,264.80; Oct. 13 to Nov. 9, '91, horses (3 cars), $538.55.

Earnings under same conditions and with the same number of cars, for the first two weeks operated by electricity, and last two weeks operated by horses: Oct. 13 to Oct. 26, '92, electricity, $680.30; Sept. 29 to Oct. 13, '92, horses, $322.60.

The growth of the city of course has had somewhat to do with this increase, but does any person imagine for a moment horse car earnings could have made any such showing?—*Street Railway Review.*

THE PHILADELPHIA TROLLEY ROAD.

The recent final decision of the courts, which opens the streets of Philadelphia to the trolley, concerned a legal technicality and not the virtues of the trolley. It is a great triumph for the electrical system, as this project embraces the largest mileage of streets in any one city on which changes from horses to electricity are contemplated in one sweep. With its 500 miles of street railways, Philadelphia heads the lists of cities of the entire world in this feature, being seconded by Chicago. Most of its roads are owned by the company who succeeded in getting the valuable trolley privileges. The change from horses to trolley, it is estimated, will make a difference of millions of dollars every year in the net profits to the company. Some idea of the size of the undertaking may be had from the fact that at least 10,000 poles will be required to equip the lines at present contemplated, and it can hardly be

doubted that this change will soon be followed by a similar one in all of the other roads of the city.—*Electrical World.*

NEW YORK CITY'S SEWAGE DISPOSAL.

In the light of modern practice in sanitary engineering, the method followed by New York City in disposing of its sewage is of the crudest kind. For years it has contented itself with simply discharging its waste of all descriptions into the rivers flowing by it, thus depositing thousands and thousands of tons of solid matter annually in its harbor, and promising, it would almost seem, eventually to impair greatly its shipping facilities by accumulations of disease-breeding offal. Fortunately for the health and prosperity of the city, however, the conditions ruling in its surrounding waterways are somewhat unique, the flow of water in the rivers and bay being so regulated by nature that there is a constant and powerful current, tending to disperse whatever solid matter of readily divisible character is discharged into it.

Still, there is little doubt that a gradual process of filling up the harbor of New York is in process, says the *Mechanical News*, and it behooves those responsible for the city's future welfare to keep the problem of rational sewage disposal in mind, with the view of adopting at some time in the near future a disposal system more in accordance with the dictates of common sense than the primitive one now practiced. Discharging sewage into adjoining waterways is the plan which naturally first suggested itself, and which was first followed in trying to get rid of the waste material of any measurably large congregation of people.

It has to commend it, directness and cheapness and reasonable efficiency. With the growth in the number of people to be provided for, however, it presents obvious shortcomings, which have become pretty well recognized all over the civilized world, and, wherever possible, it has been abandoned for some one of the several more scientific methods of disposal which have been brought into use, and which, in scores of places, are giving the most satisfactory results. New York alone, of all the large cities, has strangely lagged behind in the march of progress.

It is not reasonable to expect, however, that it can much longer follow the crude method of river carriage for its sewage. The problem of more rational disposal must be taken in hand at some time—and that not far distant—and it may, therefore, be well said that there is no time better than the present in which to take the initial steps toward its solution.—*Plumbers' Trade Journal.*

THE WILMINGTON, DEL., SEWERAGE SYSTEM.

The sewerage of Wilmington, Del., has furnished problems upon which a number of engineers have reported from time to time, as noted in our past issues. The plan which is now being followed was prepared by T. Chalkley Hatton, the engineer in charge of sewers, and is substantially a union of the combined and separate systems. The city is largely built on a hill, with a flat area of some extent at the foot, the latter being the most densely populated portion. The use of cesspools and privy vaults

has resulted in a bad state of affairs in many districts, especially where the poor classes live. An inspection of a small area in the eastern part of the city showed that out of 88 adjacent privy vaults, a like number of cellars and 7 stables, 12 of the vaults were running over, draining into a back alley; all of the stables were in the same condition, and all but eight of the cesspools emitted a decidedly nauseating odor. Water was also standing in four of the cellars to a depth of 2 to 4 inches, and in most of the others, a damp, unpleasant odor was very marked.

The sewerage system, as now designed, comprises 20 divisions, many of which need not be constructed for some time. The most difficult sections to build will be in the low, marshy areas along the rivers bounding the city on two sides, where land lies below mean high tide, with a slope toward the river of about 0.1 per cent. The population of the city is about 62,000 and its area 5,760 acres. If the city increases in the future at its past rate, large districts in its heart at present undeveloped will be built up to the average in other places, so that in the designs for the new system the maximum population has been assumed at 87 persons per acre, about eight times the present average. The size of the separate sewers is designed on the assumption that each person will furnish 100 gallons of liquid wastes in 24 hours, and that one-half of this amount will be furnished in six hours. Under these assumptions the maximum discharge will be about 0.27 cubic foot per second per acre.

In proportioning the storm water and combined sewers the surface run-off has been calculated by the Burkli-Ziegler formula, using a coefficient of 0.4 and assuming a maximum rainfall of 3½ cubic feet per second per acre. A large amount of ground water has to be provided for, the quantity being estimated at 3.6 cubic feet per acre per hour. As a general thing, sewers having a diameter under 18 inches and over 40 inches will be circular in section, while those between such limits will be egg-shaped. The sizes have been determined by the Eytelwein formula, $V = 93.4\sqrt{rs}$. The depth of the crown of the sewer, below the street level, ranges from 9 feet in the resident portions of the city to 12 feet in the business portions. Manholes will be built if possible at every change of direction or grade and at no greater distance apart than 350 feet. Lampholes will be built at the dead ends of all the small 8-inch pipes. The minimum radius of the curve with which two tangents are connected has been fixed at 20 feet.

The sewers in the hilly portions of the city have some very steep grades and the erosive action of the sewerage is correspondingly great. To resist this action, Mr. Hatton recommends constructing the inverts in such places of salt-glazed, vitrified fire-brick for the smaller sewers, and of granite blocks dressed ¼-inch joints for the larger ones. The intercepting sewers, which it is proposed to carry along the water front of the city, and portions of which are already constructed, are quite flat in places, and two pumping stations will be necessary to discharge the domestic sewage from two of the districts if the present system is carried out. The interceptors used on these sewers are of the gravity type, and are reported to have worked satis-

factorily. When the flow in the combined sewer is small, corresponding to the dry-weather flow, the opening in the bottom of the sewer and the drop between the two sides is so designed that any desired part of the sewage passes into the intercepting sewer, whereas, when this volume is increased by storm water, the resulting velocity is sufficient to carry practically all the sewage into the outfall.—*The Engineering Record.*

THE MARKET FOR PAVING BRICK.

The market for paving brick, as well as of any other manufactured article, is of prime importance, and a few thoughts on this branch of the broad subject may not be out of order.

At present the finding of a market is not giving manufacturers much concern and may not for some years to come, although this can not be foretold with certainty.

Within the last few years popular favor has turned towards brick as a material for street paving, and, as the country has been prosperous and times good, all cities and towns, of any considerable size, have instituted systems of paving and are using brick in the majority of cases.

In the previous numbers of this series of papers, the advantages of brick as a paving material over others in use was shown, and thus was demonstrated the wisdom of the people in giving brick the preference. The result of this movement has been an active demand for brick suitable for the purpose.

The conditions under which these bricks are placed and the essential peculiarities of their construction are different from those of the brick previously manufactured, and used for other purposes.

New factories have been built in various parts of the country especially planned for the manufacture of paving brick.

Up to the present time they have enjoyed a good demand for their products, but observation and experience have already taught that the demand in any one place is uncertain and fluctuating.

Paving with brick is nearly all done by incorporated cities and under the instructions of the city authorities. The condition of the finances and the wills of the councilmen each exert an influence upon the amount of paving that may be done. No one can tell very long before what action will be taken, although the subject may have been agitated and talked of for a long time. Finally the council orders certain streets and alleys paved, and instructs a committee to advertise for bids from contractors to do the work. One of the conditions by which the contractor is to be bound is that he shall complete the work within a certain time. The time given before the opening of bids is ample to allow contractors to look for places to buy brick, but the time within which the work is to be completed is not usually long enough to allow an ordinary plant to make the number necessary to complete the job. This creates a demand beyond the local supply and has a tendency, not only to lead those already engaged in the manufacture of paving brick to enlarge their plant at a considerable expense, but it also tempts new parties to invest capital in new plants. The city that creates this demand may not be in a condition financially nor the aldermen in the

mood to do more paving immediately after the completion of the first contract, and, in fact, may not do much more for several years. This is not an unlikely state of affairs, and has happened in the past. Such action, or inaction, would leave the manufacturers with their plants on their hands and no home market for their goods. They then have left the choice of three things, shut down the factory, continue to manufacture brick and hold them for future sales, or go out into the world and seek a market elsewhere.

If they chose the first and stop manufacturing brick, they are without any occupation, or at least have lost this one. They are being deprived of the opportunities of making money that they expected when they built their plant and embarked in the business. Not only do they suffer the loss of the expected income, but the capital which is invested in its business is tied up without giving any returns; neither can it be used by the proprietor to engage in any other enterprise. He can not even mortgage it for all it is worth, and let it fall into the hands of capitalists, for no one of good business judgment will lend money on a factory that is dead because there is no market for its goods.

Capital is always readily obtained for enterprises that have the appearance of thrift and prosperity, and that promise to give fair returns, but is very liable to be shy of anything that, to the casual observer, shows the opposite, and that is seeking the aid of new capital with the forlorn hope of adding new life to its already dead or dying boom.

Should the manufacturers choose the second course, and continue making paving brick when they have no immediate market for them, they must store their product and hold it until a local market is created for them through the actions of the city council.

Any one who has had experience with bodies of public officials knows that they are very uncertain, and that no safe and sure predictions can be made beforehand as to their actions.

There are two elements of uncertainty to be met with here. One is the action that may be taken by the board in office, if they take any action at all upon the subject of paving, and the other is that the next election may place new men in office. It can not be foretold who the new men will be, much less what views they may hold or what action they may take in the matter.

During all of this indefinite waiting, the expenses of operating the plant must be met. This money is stored in the stock of brick on hand. Few of the average plants are owned by men who are strong enough financially to continue upon this plan for very long.

It is true that money might be borrowed to attain this end, but this would add the interest to the expense account and reduce the profits by the amount.

The third method, that of going out into the world and seeking a market elsewhere, has several objectionable features, and introduces several items of expense that must be taken from the price received for the brick. While it is customary at present to sell manufactured goods by means of traveling men, sent out by the manufacturers to call upon the prospective buyers and solicit their orders, it must be conceded that this item of expense must be borne by the manufacturers and added to their expense account, and apportioned to the goods sold.

The brick sold away from home

must be transported from the producer to the consumer at a considerable expense, which must be either added to the cost to the consumer or deducted from the profits of the producer.

Brick are carried at a low rate of freight, but their weight is so great in proportion to their value that the cost of shipping by rail is comparatively much greater than that of other manufactured articles. This virtually excludes brick from the same advantages that are enjoyed by manufactured goods in general, whose cost of transportation is not such a large per cent. of their value.

It is commonly considered that the markets for manufactured articles are to be sought throughout the world, or at least in all parts of the country in which they are made, but paving brick can not be considered as coming under this rule.

Because of the greater cost of transportation the makers of paving brick must look for their market wholly within a comparatively limited circle.

Probably all the paving brick that are made are sold within a few hundred miles of the factory. This suggests the thought that it may not be well to establish plants of too large capacity at or near the same point.

While at present it may be true that there is an active demand for paving brick, beyond the supply, it should be remembered that in this, as in all other industries, over-production is a possibility.

It is not uncommon to hear of extensive manufactories running on short time or shutting down altogether for a time to guard against over-production and the attendant reduction in prices. Only recently the large milling interests were considering this very problem.

All are familiar with the actions of the "coal barons" of the East, and of various other large corporations engaged in different lines of business in solving this problem.

So long as those branches of the world's industries which find their markets in the daily needs of every home and throughout all countries of the globe have met and are compelled to cope with the question of the relative proportions, or disproportions, of supply and demand, it is not unwise for the manufacturers of paving brick, who have to seek their markets within a limited area, and who find their custom in the uncertain actions of municipal authorities to anticipate this matter and be prepared to meet it in all its phases.—*Clay-Worker.*

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Beatrice, Neb., has voted to issue $20,000 in bonds for new paving.

The sum of $22,186 was expended in 1892 for street cleaning in Omaha, Neb.

Baraboo, Wis., has recently laid out about $100,000 in municipal improvements.

Anderson, Ind., streets are being paved with brick at a cost of $1.73 per square yard.

The Bradford, Mass., selectmen are authorized to petition the legislature for right to extend the debt limit by $25,000 for paving Main street.

The city clerk of Gallipolis, Ohio, writes that that city is preparing to do a large amount of paving this season.

The Denver, Colo., city charter will probably be revised so that property owners shall pay the full cost of paving.

City Clerk R. B. Dennis, of Des Moines, Ia., writes that the city will soon advertise for bids for about five miles of paving.

The chamber of commerce of New York City has requested the legislature for macadamized roads throughout the state.

Evansville, Ind., proposes to pave with brick about 96,000 square yards of streets. The contracts will be awarded in March.

Edward Hough, city engineer of Sedalia, Mo., writes that contracts will be let in a month or two for paving on several streets.

Orlando, Fla., streets are being paved with clay which hardens and becomes practically impervious to water when properly laid.

Arrangements will be made for paving one and one-half miles more of Second street, Ashland, Wis. Cedar blocks will probably be used.

The street committee of Chicago wants an appropriation of between $3,000,000 and $4,000,000 for the work of cleaning and repairing streets this year.

A contract is to be let for paving with "metholithic," "granolithic" or "cinderlithic," a public alleyway sixteen feet wide and three hundred or more feet long, in West Chester, Pa. For further information address Samuel D. White or D. Morgan Cox.

Frank Suddoth, city clerk of Mt. Vernon, Ill., will advertise for sealed bids for about eleven miles of street paving with crushed limestone. The estimated cost is $125,000.

Wm. G. Smith & Son, of Norristown, Pa., have, during the past year, put down some 50,000 square feet of their improved and ornamental cement flooring in the State Hospital for Insane at Norristown.

The bonds ordered sold by the Delaware, O., council, for the improvement of North Franklin street, were awarded to the Croghan Bank, of Fremont, O., at a premium of $16. The amount of the bonds was $1,146.80.

Charles G. Carlson, city clerk of Moline, Ill., says that an ordinance has been passed providing for the brick paving of parts of Thirteenth, Fourteenth, Fifteenth, Sixteenth, Seventeenth and Eighteenth streets.

Oakland, Cal., has already expended $19,000 in partially constructing a public boulevard around Lake Merritt. The city council has transferred $40,000 from the general fund to the park and boulevard fund, so that the work of improvement can be continued at once.

The Boston common council has requested the finance committee to provide for widening Poplar street, $5,000; paving West Newton street with asphalt or brick, $8,000; paving Boylston street with asphalt or brick, $10,000, and paving Piedmont street with block stone, $5,500.

Frank R. Hoyt, a wealthy New York gentleman who has a handsome residence at Watkins where he spends much of his time, has offered to give to that village a stone crusher costing about $1,000, providing the authorities will furnish power to operate it and material for macadamizing the streets.

The cost of work under the direction of the department of public works of Buffalo, N. Y., during 1892 was as follows: bureau of engineering, $1,821,134; bureau of water, $725,269; bureau of streets, $592,230; bureau of buildings, $253,803. Buffalo has 257 miles of paved streets, principally stone and asphalt, 132 miles of unpaved streets. C. D. Zimmerman and Messrs. Cooper & Hopkins have the contracts for street-sweeping and cleaning for three years. The collection of garbage is done by the city.

The present contract expires June 1, and the board of public works has been authorized to advertise for proposals to do the work of disposing of the garbage after the present contract expires.

The city engineer of Covington, Ky., has estimated the cost of paving with brick Greenup street, from Second to Twentieth, and Scott street, from Fifth to Twentieth, at $190,692.50. As the estimate was higher than the city councilmen had supposed it would be, it is probable that brick pavements will not be laid on those streets this year.

CONTRACTS TO BE LET.

Proposals are wanted for paving several streets in Creston, Ia.

Collier street, Binghamton, N. Y., is to be paved with asphalt in the spring.

Owensboro, Ky., will pave its streets with brick at an estimated cost of $200,000.

Ironton, O., will invite bids for paving ten squares of Third street with fire brick.

Ashtabula, O., will probably let contracts in March for 20,000 square yards of brick pavement.

Parts of Miller, Liberty, Flora and Gorman streets and Dalton avenue, Cincinnati, Ohio, will be paved.

Jefferson street, from Main street to the C., B. & Q. R'y Co.'s right of way, Ottumwa, Iowa, will be paved and curbed.

Bids are wanted for watering the macadamized streets in the Back Bay and South End districts of Boston for three years.

Prospect street, from Main to Cherry, and West Main street from the Ohio canal to Henry street, Massillon, Ohio, are to be paved with brick.

St. Louis, Mo., will reconstruct twenty-six streets and alleys with granite, two with asphalt, one with brick, and three with Telford pavement.

The Canton, Ill., city council has instructed the street and alley committee to advertise for bids for paving as soon as practical. About 53,000 square yards of paving is to be done, requiring 18,400 lineal feet of curbing and 10,330 cubic yards of excavating.

The following streets in Brooklyn, N. Y., are to be graded and paved: President street, from Closson avenue to Rogers avenue; McKibben street, from Bushwick avenue to Bogart street; Degraw street, from Franklin avenue to Bedford avenue, and Fifty-first, Fiftieth, Forty-eighth and Forty-seventh streets, from Third avenue to Second avenue.

Ordinances have been passed for the paving of Belle street, Fourth street, between Piasa and State, and Second street, between Henry and Cherry, Alton, Ill. Estimates for the entire paving amount to $42,504.

More brick pavements are being planned in Quincy, Ill. Twentieth street, from Ninth to Eighteenth avenues; Eighteenth street, from Third to Seventh avenues, and Fourth avenue, from First to Twentieth streets, are to be paved.

Fulton street, from Bancroft to Webster, Toledo, Ohio, is to be paved with asphalt on a foundation of hydraulic cement concrete. Bids will be received until noon, February 13. Jefferson street will be improved with brick, cedar blocks, Hallwood blocks or asphalt.

CONTEMPLATED IMPROVEMENTS.

Muncie, Ind., will do considerable paving in the spring.

Considerable paving has been authorized at Fostoria, Ohio.

Fifty-four additional streets in Buffalo, N. Y., will be paved this year.

The question of paving Main street, Hutchinson, Kan., is being discussed.

Homestead, Pa., will expend $55,000 in grading and paving at an early date.

Elgin and Aurora, Ill., will do a considerable amount of street paving this year.

About two miles of brick paving will be constructed in the spring at Defiance, Ohio.

The city engineer of Winona, Minn., will prepare plans for paving ten streets with brick.

It is proposed to pave Easton avenue, St. Louis, Mo., a distance of three miles with asphalt.

The list of streets to be paved this year at Montreal, Que., includes nine with asphalt and four with block stone.

Colorado street, Pasadena, Cal., will probably be paved when connections with the sewer system are completed.

I. D. Wolfe, city clerk, of Goshen, Ind., writes that the city will probably order six to eleven blocks of pavement in the near future.

The San Francisco board of supervisors has passed resolutions of intention for the paving of twenty-five streets. Five streets are to be opened and extended.

The paving of east Eleventh street and parts of Charlotte street and Michigan avenue, Kansas City, Mo., is contemplated. There is talk of converting Fifteenth street into a boulevard with asphalted driveway.

T. L. McConnell, of Lexington, Ky., informs us that bids will be advertised for for the construction of Sixth street from Upper to Broadway, with macadam roadway.

The Elmira, N. Y., city council has voted to extend South avenue from Perine street to South Broadway. This will add to the Fifth ward a street 724 feet long and 50 feet wide.

J. C. Kuhlmann, city clerk of Wausau, Wis., writes that there is a movement to pave about six blocks of their principal streets this summer, but as yet no definite steps have been taken.

The city charter of Murfreesboro, Tenn., is being amended so as to enable the enforcement of the "sidewalk law;" as a consequence, considerable street work will be done there this year.

A bill is being prepared for the legislature authorizing the city of Dayton, Ohio, to issue bonds for $500,000 for paving. Three additional streets have been ordered paved, to cost about $150,000.

Ashland, Wis., feels the need of a thoroughly good drive. A drive about five or six miles in length will probably be formed by the opening of Eighteenth street from Ellis avenue to the cemetery and driving park.

The Cleveland, Ohio, city council has voted to pave fifty-two streets this year. The total distance is 20.8 miles, and is divided as follows: Dressed block Medina sandstone, 66,268 feet; common Medina sandstone, 24,184 feet; brick, 11,248 feet; asphalt, 8,512 feet. The city is planning street work to cost about $1,200,000.

One of the greatest improvements that lower New York has ever known is the contemplated opening of Elm street through to Great Jones street and Lafayette place. It has been talked of for twelve years. Its cost is estimated at nearly $3,000,000, but the money is likely to prove well invested. Starting from the plaza formed by the junction of City Hall place, Reade and Center streets, the new thoroughfare, eighty feet wide from end to end, will proceed north until it merges into Lafayette place, which is 100 feet wide, and which ends in the plaza at Eighth street. The new street will be only one block east of Broadway, and the traffic on that thoroughfare will thus be partly relieved. Beginning at Great Jones street, several whole buildings will be taken, and throughout the whole length of the street it will be necessary to chop off from fifteen to thirty feet of buildings. Twenty feet will be taken from the rear of an old Episcopal church and twenty-five feet from the new Puck building. Even picturesque old Tombs will lose eighteen feet of its rear wall, but the city will gain a fine new street where it is badly needed.

City Engineer John R. Seibert, of Pekin, Ill., informs us that estimates for 14,812 square yards of pavements are now before the county court for confirmation, and if confirmed, contracts will be let at an early date. The Peoria Paving Block Company secured the contracts for paving last year, and also built 1,400 feet of five-foot sewer.

The Jamestown, N. Y., board of public works has recommended the following work: 72,721 sq. yds. brick paving, estimated cost $2 per sq.yd.; 7,610 sq.yds. stone paving, $3.25 per sq.yd.; 32,436 lin. ft. stone curbing, 42 cents per lin. ft.; 2,136 lin. ft. iron gutter, $2.30 per lin. ft. Bonds are asked for $60,000 to pay the city's share of the expense.

The Wightman tract of land in Milwaukee has been purchased by Chicago and Milwaukee capitalists. Lake avenue and Newberry place are to be paved with asphalt, and the latter, which is 159 feet wide, will have a park fifty feet wide running through the center, with a roadway on either side. Every street in the tract is to be improved, and the city's gas, sewer, and water systems introduced before any lots are offered for sale.

CONTRACTS AWARDED.

E. C. Culver has a contract for street paving in Boone, Iowa, to commence March 15.

E. G. Church has been awarded the contract for one-half mile of street paving in Sedalia, Mo., with "improved Telford," at $2.00 per square yard.

The following contracts for paving brick have been awarded in Washington, D. C.: Charles Ford, 100,000 to 500,000, at $9.50 per M.; Washington Brick and Terra Cotta Company, 50,000 to 200,000, at $10, and $11 per M.; Ivy City Brick Company, 50,000 to 300,000, at $10.50 per M.

A. J. Pugh & Co, of Columbus, Ohio, have recently completed a contract for paving Main street, Richmond, Ind., from Sixth to Ninth streets, with Canton Standard paving brick, and also a contract for paving Converse street, from Main to Angle streets, Dunkirk, Ind., with "Parto Block."

The Mt. Vernon Brick Co. has been awarded the contract for building about nine miles of brick walks in Mt. Vernon, Ill., and the Missouri Granitoid and Sidewalk Co. has the contract for two miles of brick walks and half a mile in addition to the three miles of granitoid walks they have already laid. The Indiana Contract Co., of Evansville, Ind., have the contract for constructing about four miles of street with crushed stone and Paducah gravel.

A contract has been awarded to Isaac F. Reeder, Indianapolis, Ind., for sweeping streets and alleys paved with brick, at sixty cents per 10,000 square feet, and Kentucky avenue, which is paved with asphalt, at thirty-five cents per 10,000 square feet, the sweeping to be done either daily or triweekly.

David Ryan, of Alton, Ill., has secured the contract for paving and curbing Main street, Venice, Ill., for $26,000. Mr. Ryan's bid was $1.55 per square yard. The contract calls for six inches of sand at the bottom and two courses of brick. The brick will be of Alton manufacture, and Venice will be the first town to use that product.

Repairs to asphalt pavements in Cincinnati during 1893 will cost the city about $8,300. Contracts for repairs have been let as follows: The Trinidad Asphalt Company, Seventh, from Vine to Freeman, $1,000 per annum; Walnut, $520; Eighth, $150; Ninth, $1,500; Main, $480; Central avenue, $108; Seventh, from Freeman to Carr, $90: Warren-Scharf Company, McMillan, $860; Garfield Place, $50; Government Square, $30.

J. F. Barrett, city clerk of Sterling, Ill., sends us the following information: A contract was let on Jan. 16 for grading, paving and curbing five blocks of Third street in the business district. The bids were—John Bassler, Galesburgh, Ill., $28,784.95; Henry Bessler, Cedar Rapids, Iowa, $27,612.98; C. E. Loss, Chicago, $34,365.06; Rockford Construction Co, Rockford, Ill., $26,425.50; Edwards & Walsh, Davenport, Iowa, $28,223.06; Wilson & Thatcher, Chicago, $25,778.16, and J. P. Calnan Construction Co., Clinton, Iowa, $32,958.60. The contract was awarded to Wilson & Thatcher, who have filed bonds and begin work April 1. The contract ends July 1, 1893.

SEWERAGE.

The Rogers Park, Ill., village council has adopted the gravity system of sewers.

The estimated cost of a sewerage system at Glenwood Springs, Colo., is $13,000.

Wheaton, Ill., has voted down a plan for building sewers, as being too expensive.

The new sewerage system of Tyler, Texas, will cover twenty-eight blocks in the principal parts of the city.

It is probable that the original estimate of $186,384 for twenty-eight miles of sewers in Everett, Mass., will be exceeded by $100,000.

One of the most extensive and complete sewer systems in the West has just been completed in Deadwood, S. Dak., at a cost of $40,000. E. J. Lawton was the contractor.

Adrian, Mich., has laid a twelve-inch pipe sewer with twenty-two Y junctions; length, 888 feet; average depth, seven feet; cost per lineal foot, 58 cents; wages paid, $1.50 per day.

The Sixth street sewer, Great Falls, Mont., is now completed. It is over half a mile long, four feet in diameter on the inside, and laid in two courses of brick. This sewer, which is the largest in Montana, has cost the city $20,000.

Health Commissioner Wingate, of Milwaukee, is making an effort for the establishment of a drainage commission, with a view to remedying the evil caused by drainage flowing into the Menomonee river. While the completion of the intercepting sewer system next spring will do away with city sewerage going into the river, still the river will continue to be polluted by the drainage of a district in which more than 10,000 people reside.

CONTRACTS TO BE LET.

Nelsonville, Ohio, will construct a sewerage system this year.

Sewers will be laid in Third and East Fifteenth streets, Oakland, Cal.

The city clerk of Des Moines, Ia., will advertise for bids for eight miles of sewers.

J. W. Sparks, Jr., writes that Murfreesboro, Tenn., will soon put in a $30,000 system of sewers.

Contracts for about two miles of sewers in Scottdale, Pa., will probably be awarded about March 1st.

Hinds & Bond, of Watertown, N. Y., are making plans and surveys for sewers in Carthage, N. Y., contracts for which will be let soon.

Ordinances have been passed for the construction of sewers in five streets in Newark, N. J. Assessments are being made for pipe sewers in ten streets.

An ordinance has been passed authorizing the department of public works to enter into contracts for construction of sewers in thirty-nine streets of Philadelphia.

Proposals will be received at the auditor's office, of Hastings, Minn., until March 14th for the construction of a sewer from the jail to the Mississippi river according to the plans and specifications on file.

Bids will be received at the office of J. A. Stevenson, city clerk of Monmouth, Ill., until noon, February 6, for the construction of 1,040 feet of thirty-inch brick sewer and 39,000 feet of pipe sewer, six to twenty-four inches.

CONTEMPLATED WORK.

Ironton, Ohio, will spend $20,000 on the sewer system.

Valdosta, Ga., will probably have a sewerage system.

Sacramento, Cal., wants a new and better sytem of sewerage.

Southington, Ct., will probably construct a new sewerage system.

A sewerage system is proposed for the first ward of Syracuse, N. Y.

Plans are being prepared for a system of sewerage in Taylorville, Ill.

Sioux Falls, S. Dak., contemplates the construction of sewers to cost $150,000.

Extensive improvements in the sewer system of Peoria, Ill., are contemplated.

A large sewer around the public square in Centerville, Iowa, is again being agitated.

The common council of Troy, N. Y., is considering the construction of about 25,000 feet of sewers.

The construction of a sewer system is being urged at Brunswick, Ga., at an estimated cost of $60,000.

The mayor of Manchester, N. H., recommends that bonds be issued for the extension of the sewer system.

A survey of the village of Geneva, N. Y., is being made with a view of establishing an extensive system of sewers.

The San Francisco sewerage commissioners have recommended the construction of sewers in Scott and Filbert streets.

Holyoke, Mass., will expend $300,000 in sewer construction this year. A system is needed in Elmwood, Oakdale and Springdale.

The city council of Tacoma, Wash., is considering plans for a sewer to drain about 800 acres, and estimated to cost $41,700 to $44,500.

North Denver, Col., property owners are urging operations on the new sewer district as recommended by the board of health.

The sewer frontage of the new sewer district No. 2, Aurora, Ill., is 40,000 feet, and the estimated cost of construction is about $70,000.

M. P. Schooley, clerk of Homestead, Pa., writes that an election will be held February 21 for the purpose of borrowing $15,000 to build a sewer.

A gravity sewer system is discussed in Salt Lake City, Utah. Sewer extensions are to be made on West Temple and Second East streets.

Engineer H. J. Reid, of Colorado Springs, Col., has prepared plans for a system of sewers for Boulder, Col., which is estimated to cost $36,000.

Geo. E. Waring, Jr., of Newport, R. I., has just completed sewerage plans for Weirs, N. H., and Charlottetown, Prince Edward Island, Canada.

H. C. Allen, city engineer of Syracuse, N. Y., has prepared plans for a 6x8 ft. stone sewer in the Harbor Brook Valley. The estimated cost is $280,000.

Frank Snyder, sanitary engineer, of Columbus, O., has prepared a plan of main sewerage for the village of London, O. The estimated cost of the same is $73,000.

The city engineer of Columbus, O., is preparing a plan and estimate for the extension of the southeast main trunk sewer from its terminus in Forest street to Oakwood avenue.

Plans have been completed for the proposed sewer in the sixth ward, Portsmouth, O. It will drain 225 acres, and cost about $30,000. There will be 7,830 feet of brick sewer and 6,830 feet of pipe.

The board of public works of Saginaw, Mich., has recommended the construction, during the present season, of the sewer in Vermont street, from Hamilton to Fayette street, at an estimated cost of $4,100.

Engineer Elliott, of the Memphis, Tenn., sewer department, estimates that a main 36-inch sewer along Georgia street from the river to Mississippi avenue, can be constructed for between $60,000 and $70,000.

The Nashville, Tenn., city council proposes to spend $400,000 for sewer purposes this year. The legislature has been petitioned for authority to issue bonds to this amount. The sewers to be constructed will be principally main sewers, built of brick.

Plans for a new $60,000 sewer are being prepared at Kansas City, Mo. There will be two miles of brick main from two to four and a half feet in diameter, and 16,750 feet of twelve-inch pipe. There are to be ninety-six catch-basins and thirty-three laterals.

The sewer board of Far Rockaway, N. Y., has voted in favor of the gravity system of sewerage, and the plans of T. D. Smith and J. J. Powers for sewage disposal. The estimated cost of constructing the proposed 14,560 feet of sewers, gravity system, is $24,000 to $29,000. The deepest cut is 14 feet 8 inches, and average cut 9 feet. It will be necessary to erect disposal works, as by a decision of the state board of health the village can not empty its refuse matter into the bay or the ocean. This will increase the expense by about $65,000.

The question of sewers in Berwick, Pa., will be voted upon on the 21st of February. Complete plans and specifications have been prepared by Alex. Potter, of Olean, N. Y. It is proposed to construct eight miles at present, at an estimated cost of $45,000. Pipe sewers ranging from eight to twenty inches will be used.

The Cleveland, Ohio, Board of Control has prepared plans for sewers in five streets. Work will be commenced early in the spring on the Walworth Run sewer, which will be fifteen feet in diameter, and will empty into the river. Its estimated cost is $200,000, and its construction will occupy about two years. It will drain nearly all of the West and South sides, and is to be built so as to connect with a main sewer under the river, if one is built.

WATER-WORKS.

The Minneapolis, Minn., city water-works department last year netted over $100,000.

Chief Engineer Robert Van Buren, of Brooklyn, N. Y., estimates that it will require over $3,000,000 to place the works in a proper condition to supply the city,

The Manchester, N. H., board of water commissioners have asked for appropriations amounting to $132,000 for the use of the water department during the current year.

The city of Boston has purchased the property of the Jamaica Pond Aqueduct Company at $125,332. This system furnishes the water supply for Roxbury and Jamaica Plain.

The contract for the firs section of the new supply conduit, at Rochester, N. Y., 12,000 feet of masonry conduit, 6 to 6½ feet high and wide, has been awarded to Wm. H. Jones & Sons, for $292,513.

The wooden pipe portion of the new water-works system of Logan, Utah, has been laid. It is a continuous redwood pipe, bound with iron bands, and is capable of resisting an immense pressure.

Council Bluffs, Iowa, has an admirable water-works system. Water is taken from the Missouri river at a point north of and above the city, and is pumped through a closed iron conduit to three large reservoirs in the city. It is conducted from one to the other of these reservoirs, being allowed to settle in each, and from here is pumped to a large distributing reservoir. The water-works company made extensive improvements last year, adding one new reservoir and a system of weirs between the reservoirs. All the reservoirs are cemented on the sides and bottom. The works are capable of furnishing 8,000,000 gallons of good, clear water each twenty-four hours, while from 15,000,000 to 20,000,000 gallons can be pumped from the river into the reservoirs each day. This city is provided with over 1,000,000 feet of mains and 275 fire hydrants.

CONTRACTS TO BE LET.

Lacrosse, Wis., will lay $25,000 of mains this year.

The Bonham, Texas, city council is open for bids for a water-works system.

The Beatrice, Neb., water-works plant is to be completed at a cost of about $7,000.

The Cleveland, Tenn., board of aldermen have accepted plans for a system of water-works to cost $40,000.

A reservoir with a capacity of 1,000,000 gallons is to be built in connection with the water-works system of Rockford, Ill.

Water-works will be put in at Columbia, Mo.; Grayton, W. Va.; El Paso, Tex.; Alabaster, Mich.; Elberton, Wash ; Girard, Pa.; Groesbeck, Tex.; Kenosha, Wis.; Fitchburg, Mass.; Coxsackie, N. Y.; Wilson, N. C.; Nelsonville, O.; Bowie, Tex.; Edinburg, Ind., and DeKalb, Ill.

CONTEMPLATED WORK.

A water company is proposed at North Woodbury, Conn.

Another private water plant is talked of at Fayetteville, N. C.

Spokane, Wash., has decided to spend $312,000 in the laying of pipes.

A water-works system for Dillon, Mont., is being discussed. The estimated cost is $25,000.

Rockvale and Lafayette, Colo., are making preparations for putting in water-works.

Contemplated improvements in the water-works system of Sarnia, Ont., will cost $17,000.

Northumberland, Pa., will probably put in gravity works with thirty hydrants, in the spring.

The city council of Connersville, Ind., is debating the question of an improved system of water-works.

DeKalb, Ind., intends to increase its water supply. Alderman Everett is chairman of the water committee.

City clerk of Bushnell, Ill., writes that the council has voted to sell or lease the city water-works to any one who will pipe water a distance of four miles from springs and guarantee a supply, the city to again purchase the works after the improvements are made. The works cost about $25,000.

Edinburg, Ind., will build water-works. There will be two miles of mains, fifteen hydrants, wells, pumping plant and a standpipe.

The water-works of Yonkers, N. Y., need an additional storage capacity of 550,00),000 gallons, which may be secured by building a short dam across an existing supply pond and building the proposed Palmer Hill reservoir, with a capacity of 333,000,000 gallons.

Bonds to the amount of $250,000 have been ordered issued to begin the construction of a high service system in New York City, including a 24,000,000 gallon pumping station and a large water tower. The city has the authority to issue $500,000 of bonds for the system.

Engineer S. E. Babcock, of Little Falls, N. Y., has reported on village water-works for Fort Edward, N. Y., recommending a gravity supply, two reservoirs, a filter chamber, an 8,160-foot supply main of 20-inch pipe, and a distributing system. The estimated cost, exclusive of land and water rights, is $106,087.

City Engineer Clarke, of Chicago, Ill., has estimated the cost of extending the two-mile tunnel two miles and a half further into the lake, at $778,000. The extension is being considered as a means of keeping the four-mile tunnel water free from pollution when the supply from the two-mile crib is impure. Mr. Clarke says the extended tunnel must have a diameter of ten feet ten inches in order to supply the old tunnels running from the crib to the shore.

The water-works question is being discussed at Davenport, Wash., Brattleboro. Vt, Newman, Ga., Turner, Ill., Hartington, Neb., Colville, Wash., Fort Edward, N. Y., Cameron, Texas, New Cumberland, Ohio, Duquesne, Pa., Lakewood, N. Y., Northfield, Vt., Pepperell, Mass., Newton, N. J., Valdosta, Ga., Grille, Miss., Water Valley, Miss., Napoleon, Ohio, Centerville, Iowa, Nelsonville, Ohio, Oakley, Texas, Colby, Texas, Newton, Iowa, Geneva, Ohio, and South Charleston, Ohio.

CONTRACTS AWARDED.

Stanberry, Mo., is constructing its own water-works, as no suitable bids were received on contract.

The contract for putting in water-works at Carthage, N. Y., has been let to Moffett, Hodgkins & Clark, of New York. C. O. McCombs is overseeing the construction of same.

J. F. Wilson, city clerk of Grinnell, Ia., writes that the city has a contract with J. P. Miller & Co., of Chicago, to drill a well and guarantee to furnish 150,000 gallons of water suitable for culinary and mechanical uses. The contract price is $3 50 per foot, but in no case is the city to pay for over 2,000 feet. The city expects to put in water-works costing from $25,000 to $30,000, and sell bonds to pay for the same.

BRIDGES.

Atwood, Colo., wants a new bridge.

A new bridge at D street, Marysville, Cal., will be built in the fall.

A bridge is wanted across the river at Columbus street, Jackson, Mich.

A new bridge is to be built across the river on Central avenue, Delaware, O.

The question of a bridge across St. Louis bay from West Duluth to Superior, is again being discussed.

The question of a bridge over the Mississippi river at New Orleans is being very thoroughly discussed.

It is proposed to construct a viaduct across the Menominee valley at Sixteenth street, Milwaukee, Wis.

The citizens and common council of Red Wing, Minn., are in favor of bridging the Mississippi at that point.

The F. & P. M. R. R. Co. will construct an iron bridge across the Saginaw river, near Flint, Mich., at a cost of $50,000. Contracts for a portion of the heavy work have already been let.

The Milwaukee Bridge Company has secured contracts for building an iron bridge across the Wisconsin river at Merrill, Wis., for $16,490, and across the Yellow river at Marshfield for $3,123.

The bridge across the valley between Brooklyn and Brighton, O., which was built seven years ago at a cost of $40,000, is dangerous. A new one will probably be constructed at a cost of $125,000.

A bill has passed the Dayton, O., city council, providing for the issuance of bonds for the construction of a $35,000 viaduct at the Third street crossing. The railroads will be assessed for half this amount.

Patrick Maley has been awarded the contract for building a stone bridge at Dayton, Tenn. We are informed by Howard Teasdale, city clerk, that a contract will be let for the building of a bridge in Sparta, Wis.

If the plans are carried out, the proposed wagon road, footway and electric railway over the Merchants' bridge at St. Louis, Mo., will be built before the close of the present year. The estimated cost is $350,000.

A viaduct will be constructed over the tracks on West O street, Lincoln, Neb. The roadway will be twenty-five feet wide with a sidewalk six feet wide on each side. The structure is to be supported by wrought iron columns, with stone pedestals. Between the columns will be steel girders strong enough to support a maximum load in addition to the weight of the bridge.

STREET LIGHTING.

Bids are being received for street lighting in Columbus, Ga.

Kansas City, Mo., will soon operate an electric light plant of its own.

Richmond, Ind., is willing to expend $40,000 for a good electric light plant.

Fifty additional electric street lights have been contracted for at Mascoutah, Mo.

The city council of New Castle, Ind., has voted to purchase and operate an electric light plant.

D. E. Fox, city clerk of Carrollton, Ill., says the electric light question is being discussed there.

City Clerk T. F. Higby, of Fairfield, Ia., says that city is looking into the incandescent lighting business.

An apportionment of $87,500 has been made for 789 additional electric street lamps in New York City.

A contract has been made for lighting Muskegon, Mich., for the next five years. Each light will cost $93.50 per year.

The board of public works of Jamestown, N. Y., has recommended that the municipal electric light plant be extended, at a cost of $15,000.

Electric light plants will be put in at Toreley, Md.; Franklinville, N. Y.; Columbia, Mo.; Mineral Ridge, Ohio; East Orange, N. J., and Chenoa, Ill.

The proprietors of the Pomona, Cal., Gas and Electric Light Company have determined to put the gas rate at $2 per 1,000 cubic feet, a concession of not less than 33⅓ per cent.

I. W. Holt, city recorder of Dayton, Tenn.. informs us that contracts are to be let for from 70 to 100 gasoline or oil street lamps; also for erecting the same, furnishing, posts, etc.

Electric street lights are discussed at Paris, Tenn.; Clyde, O.; Stanhope, N J.; Cheshire, Mass.; Gainesville, Fla.; Shelbyville, Ky.; Kendallville, Ind.; Georgetown, Tex.; Waynesville, N. C.; New London, O.; Plymouth, O., and Onalaska, Wis.

The Boulder Electric Company has been awarded the contract for lighting the city of Boulder, Colo., for another year at $9.50 a lamp per month, a decrease of thirty cents per light per month.

Ann Arbor, Mich., has contracted with the Ann Arbor Thomson-Houston Electric Company for eighty-five arc street lights, of two thousand candle power each, at eighty-one dollars per lamp per annum.

The committee on lights of the Richmond, Va., councils wants bids for the auxiliary water gas plant to be erected at the city gas works. An appropriation of $25,000 for the purpose has been agreed upon.

Alton, Ill., is considering bids for electric lighting. Owing to a failure to come to any agreement as to price, the Alton Gas and Electric Light Co. has refused to furnish either gas or electricity to the city since January 1st.

It is reported that all the electric railway and electric light companies in Maine are to be consolidated into one company with a capital stock of between $4,000,000 and $5,000,000. It is stated that the company will ask the next legislature for a charter to buy a lease to build and operate street railways, light, heat and power companies throughout the State.

F. A. Smink, secretary of ths Shamokin, Pa., council, informs us that that city has contracted with the Shamokin Arc Light Company for 35 arc 2,000 candle power all-night lights, at $90 per light per year, and with the Shamokin Electric Light and Power Company for 26 lights at $90 per light per year, and eight lights at $60 per light per year, contracts to run five years.

PUBLIC PARKS.

There is a move for park improvements in Burlington, Iowa.

The Madison, Wis., fair grounds may be purchased by the city for park purposes.

The West Park Board, Chicago, has appropriated $100,000 for a museum in Garfield park.

The Franklin Park commissioners of Columbus, Ohio, will petition the legislature for authority to issue bonds for $100,000 for park improvement.

Some Boston capitalists have about decided to build an electric road from Wilmington, Del., to Brandywine Springs. If they succeed in purchasing the grounds there they will convert them into a public park, with such attractions as will make them a popular resort.

An amendment to the city charter of Denver, Col., will probably be made so as to allow the city to create a bonded indebtedness, the money thus obtained to be used in the purchase of ground for park purposes.

The cost of maintaining the parks of Seattle, Wash., last year was $22,337. The estimate for the ensuing year is $27,827. The park commissioners propose to locate a grand park from Madison point through Hunter's glen and reaching to the peninsula on the west shore of Lake Washington. They want a boulevard not less than seventy-five feet wide and extending from Bailey's point to the north line of McGilvra's property on Union bay, closely following the shore line.

The sum of $100,000 is set apart for buying a park in the southeast part of Omaha, Neb., and $75,000 for the Parker, or some other tract, in the northeast. The value of Omaha's parks, not counting parkways or boulevards, is $1,075,000. Last year the city expended $20,017 in permanent improvements in parks.

STREET RAILWAYS.

Allison B. Laine, village clerk of Canisteo, N. Y., informs us that a street railway is to be laid there as soon as the frost is out of the ground.